Memo

To: Mayor Mileski & City Council Members

From: Melinda Greenwood, City Administrator

Meeting Date: April 28, 2015

Re: Discussion and Possible Action on Adopting Resolution # 2015-B Approving the 2015 Little Missouri Spring Water Source Protection Plan

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I. RECOMMENDED ACTION

Move to approve Resolution # 2015-B Approving the 2015 Little Missouri Spring Water Source Protection Plan.

II. DESCRIPTION / BACKGROUND

In October of 2011, the City Council adopted the Little Missouri Spring Drinking Water Source Protection Plan (DWSP), which is a State Division of Drinking Water requirement.

In December of last 2014, after a technical review of submittals for Harris Hills Phase II, the City determined there was a detrimental conflict between the City's source protection zones for the Little Missouri Spring, and the proposed subdivision design. In January 2015, staff and the Mayor held a meeting with the development applicant and discussed the existing zones as determined by the 2011 Little Missouri Spring DWSP. The City's drinking water source protection plan and our ordinance wouldn't allow for the development of the subdivision to move forward as it would put Potential Source Contaminants in zone 1 and zone 2 of the spring's protection areas.

After careful consideration of many options and inclusion of the City's Water Subcommittee in the process, staff determined that best resolution to the conflict was to more accurately determine and pinpoint the source for the Little Missouri Spring.

Through efforts of cameraing the spring lines, field assessments and potholing the area, the source point was better identified and documented. Staff sent GPS points of this new source location to Hansen Allen & Luce Engineers, Inc. and they conducted a study and produced a report of a new delineation for the source protection zones.

This report was provided to the City in March, and our contract engineer subsequently updated the 2011 Little Missouri DWSP with the new information. The new zone delineation for the Little Missouri Spring has been sent to the State of Utah Division of Drinking Water so they can keep the source zones on file.

At the March 24, 2015 City Council Meeting, the City Council choose to amend Ordinance #2002-2, which clarified that the City's standard for drinking water source protection zones would be whichever standard is more stringent, which in most cases will be the plan.

The Council's approval of this plan will be the last step in the process for updating the zone delineation.

The new zone delineation has allowed the development application for Harris Hills Phase II to move forward as designed, as the more accurately identified spring source point and protection zones are no longer in grave conflict.

Council approval of this plan is not required for the developer to move forward in the process, so their efforts have not been stalled. The new zone delineation was provided to the applicant in March and since that time, staff and the applicant have been back and forth with comments and submittals. The final plat approval on Harris Hills Phase II will be scheduled when the application has addressed all the comments in the technical review.

Hopefully this background can assist the Council in understanding why the 2011 plan was updated.

Staff is confident the new source point is as accurate as can be, and recommends approval of the 2015 Little Missouri Spring Drinking Water Source Protection Plan.

III. IMPACT

A. Fiscal

IV. ALTERNATIVES

V. SCHEDULE / TIME CONSTRAINTS

A. None

VI. LIST OF ATTACHMENTS

A. Resolution #2015-B

B. 2015 Little Missouri Spring Water Source Protection Plan

Resolution # 2015-B

A RESOLUTION OF PLEASANT VIEW CITY COUNCIL ADOPTING THE MARCH 2015 LITTLE MISSOURI SPRING DRINKING WATER SOURCE PROTECTION PLAN

WHEREAS, the Little Missouri Spring is an integral part of Pleasant View City's water system and provides approximately 7% of the water supply to our system; and

WHEREAS, in October of 2011, the Pleasant View City Council approved the Little Missouri Spring Drinking Water Source Protection Plan in efforts to preserve and protect water for all current and future residents; and

WHEREAS, in December of 2014 it was determined by City staff that a development conflict existed between water source protection zones and proposed development in Harris Hills Subdivision Phase II; and

WHEREAS, the City felt the need in January 2015 to update and most accurately define the delineation for Little Missouri's water source and its protection zones; and

WHEREAS, the City expended time, effort and funds and utilized both cameras and potholing methods to determine a new source point for the Little Missouri Spring; and

WHEREAS, in February of 2015, this data point was provided to Hansen Allen & Luce Engineers, Inc., a licensed engineering firm certified and experienced in geologic, hydrogeology and aquifer fields, so they could conduct a study of the water source and protection zones based on this new data point; and

WHEREAS, through their expertise, Hansen, Allen & Luce Engineers, Inc. derived a new delineation for all water source protection zones for the Little Missouri Spring; and

WHEREAS; the Little Missouri Spring Drinking Water Source Protection Plan has subsequently been updated; and

WHEREAS, this updated delineation has been submitted to the State of Utah Division of Drinking Water; and

WHEREAS, the City Council has authority over the City's plans and ordinances; and

WHEREAS, staff recommendation is that the City Council approve the March 2015 Little Missouri Spring Drinking Water Source Protection plan.

NOW, THEREFORE BE IT RESOLVED, that by signatures below, the Pleasant View City Council does approve and adopt the updated March 2015 Little Missouri Spring Drinking Water Source Protection plan.

Signatures on following pages

APPROVED this 28th day of April, 2015

Toby Mileski, Mayor

Attest:

Laurie Hellstrom, City Recorder

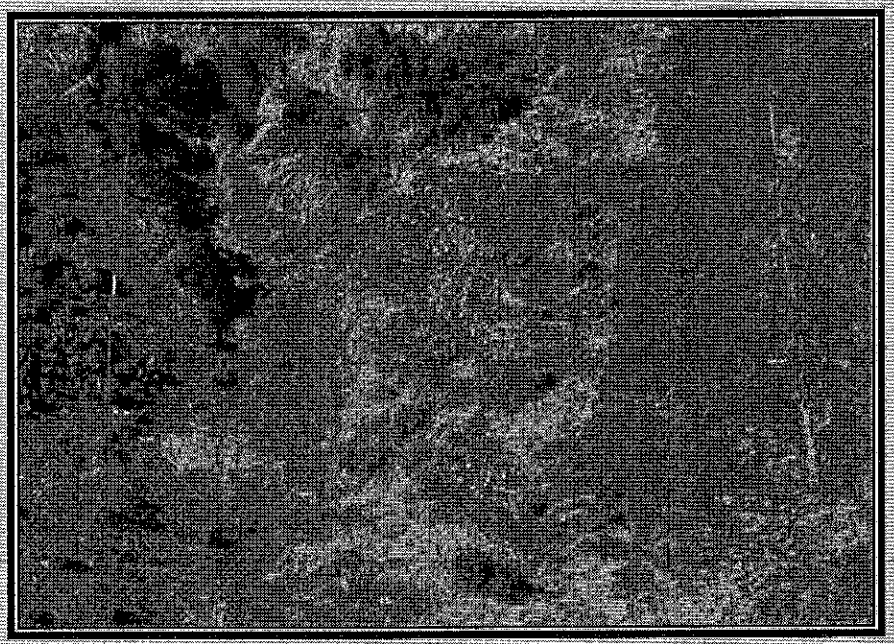
This resolution passed by the following roll call vote of the Pleasant View City Council:

		YES	NO	ABSTAIN	ABSENT
City Council Member	Boehme	____	____	____	____
City Council Member	Burns	____	____	____	____
City Council Member	Gibson	____	____	____	____
City Council Member	Humphreys	____	____	____	____
City Council Member	Pitman	____	____	____	____

PLEASANT VIEW CITY CORPORATION

DRINKING WATER SOURCE PROTECTION

LITTLE MISSOURI SPRING



Prepared by

JONES & ASSOCIATES
Consulting Engineers

JONES & ASSOCIATES
Consulting Engineers

March 2015

Pleasant View City

JONES & ASSOCIATES CONSULTING ENGINEERS

March 18, 2015

Source Protection
Utah Division of Drinking Water
P.O. Box 144830
Salt Lake City, UT 84114-4830

RE: Pleasant View City Corporation – Drinking Water Source Protection Plan

To whom it may concern:

Submitted herewith is the updated Pleasant View City Corporation Drinking Water Source Protection Plan for the Little Missouri Spring. This is submitted as required by the Utah Administrative Code, Drinking Water Source Protection Rule R309-600.

Should you have any questions or concerns, please let us know.

Sincerely,

JONES AND ASSOCIATES
Consulting Engineers

Brandon K. Jones, P.E.
Jones & Associates Engineers

cc: Jay Palmer
Pleasant View City
Public Works Director

1716 East 5600 South • South Ogden, Utah 84403 • (801) 476-9767 • FAX (801) 476-6768

Pleasant View City Corporation
Drinking Water
Source Protection Plan

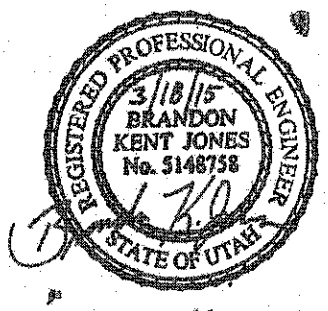
for

Little Missouri Spring

Source Number: 01

June 2002

Updated: March 2015



Prepared by:

JONES & ASSOCIATES
CONSULTING ENGINEERS

1716 East 5600 South
South Ogden, UT 84403
(801) 476-9767

Table of Contents
Pleasant View City Little Missouri Spring

JONES & ASSOCIATES

EXECUTIVE SUMMARY

Jones and Associates has been employed by Pleasant View City Corporation to Provide Engineering services to assist the City in creating and updating the Drinking Water Source Protection Plans (DWSP) for the City's drinking water supply sources. The DWSP plan is developed in accordance with the Drinking Water Source Protection Rule, R 309-600 of the Utah State Administrative Code. This report is an update to the DWSP program for the drinking water supply of the Little Missouri Spring. A description of the DWSP requirements are as follows:

DELINEATION REPORT

The Delineation Report for the Little Missouri Spring was recently updated by Hansen Allen & Luce Inc. and will be submitted to the State with this plan. A typical Delineation Report determines the following required protection zones:

* Zone 1 is the area located within the 100-foot radius of the spring.
* Zone 2 is the area located within the 250-day ground-water travel time to the spring.
* Zone 3 is the waiver zone, and includes the area located within a 3-year ground-water travel time to the spring.
* Zone 4 is the area located within the 15 year ground-water travel time to the spring.

The results of the Delineation Report was the mapping of the above four delineation zones. These zones were determined using geological mapping, USGS mapping, testing from existing wells in the area and other relevant data to calculate the appropriated travel time for the source water to the Spring collection area.

POTENTIAL CONTAMINATION SOURCE INVENTORY

The Potential Contamination Source Inventory (PCSI) addresses a two step approach to inventory the Potential Contamination Sources (PCS's) within the delineated zones determined in the delineation report as follows:

Step 1--Potential Contamination Source Inventory

This step involves the actual inventory of the PCS's within each of the delineation zones. The initial inventory identifies all activities within the delineation zones around the spring. From the inventory all activities with contamination potential are identified.

Step 2--Prioritized List of Potential Contamination Sources

This step involves the evaluation and subsequent prioritization of the PCS's. The prioritization places a ranking sequenced from the most to the least in its potential for causing a contamination to the drinking water source.

MANAGEMENT PROGRAMS

The purpose of the Management Program is to provide the City with an outline to protect the drinking water source from each of the PCS's. The management program is broken down into two steps as follows:

Step 1--Management Program to Control Existing Potential Contamination Sources

This step involves a set of management plans to control existing PCS's within each of the delineation zones.

Step 2--Management Program to Control Future Potential Contamination Sources

This step involves a set of management plans to protect the water source by controlling future PCS's that could be established within each of the delineation zones.

IMPLEMENTATION SCHEDULE

The purpose of the Implementation Schedule is to provide a listing of all land management strategies which have been identified by the public water system for both existing and future potential contamination sources along with a beginning implementation date for each one. Land management strategies must be implemented according to this schedule.

RESOURCE EVALUATION

The purpose of the Resource Evaluation is to discuss the financial and other resources which are required for the public water system to implement this DWSP Plan and a determination of how these resources are to be acquired.

RECORD KEEPING

The purpose of the Record Keeping Section is to document changes as the plan is continuously updated to show current conditions in the protection zones and management areas. The public water system must have a record keeping system which will document each land use strategy including ordinances, codes, permits, memoranda of understanding, public education programs, training sessions, minutes of meetings, diary entries, memoranda, etc.

CONTINGENCY PLAN

The required Contingency Plan is submitted for the entire water system. It is a "stand alone" document and is not included in this report but is submitted and approved as a separate document.

UPDATED SUMMARY

The Little Missouri Spring's delineated protection zones were re-evaluated in February of 2015. This report is an update to the original DWSP plan for the Spring with reference to the updated Delineation Report.

Pleasant View City enacted a Drinking Water Source Protection Ordinance on the 26th of March 2002. Weber County has enacted ordinances for sewer lines and septic systems located within protection zones, and a Drinking Water Source Protection Zoning Ordinance. The Pleasant View City Ordinance supercedes the County Ordinances within the City Corporate Boundary and within any City owned property. The Weber-Morgan Health Department has also enacted Source Protection Ordinances. These ordinances were modeled after the draft ordinance contained in the "Source Protection Users Guide". The ordinances will help in restricting future PCS's from moving into a protection zone. **(Appendix C)**

1.0 INTRODUCTION

1.1 System Information:

- Water System Name: Pleasant View City Corporation
- Water System Number : 29014
- Address: 520 West Elberta Drive
  Pleasant View City, Utah 84414
- Phone Number: (801) 782-8529

Pleasant View City's water system is an existing water system that serves the citizens of Pleasant View City. It is a public community water system.

1.2 Source Information:

Little Missouri Spring is located within a ravine on the west side of Pleasant View City. The flow in the Little Missouri Spring is collected at the source by means of some unknown length of perforated collection pipe that discharges into the spring box at an approximate elevation of 4,780 feet. The flow is then diverted into a 6-inch diameter transmission pipeline and conveyed to a concrete storage reservoir. No construction drawings or construction data are available for the Little Missouri Spring. Little Missouri Spring has an average flow of 6 gpm and a peak flow of 14 gpm. The collection area is fenced.

- Source Name: Little Missouri Spring
- Source Number: 01
- Source Type: Existing Spring
- Source Information: Individual Source
- Source Locations: 670 feet South & 470 feet West from the North Quarter Corner of Section 19, Township 7 North, Range 1 West, Salt Lake Base & Meridian

1.3 Designated Person:

- Name: Tyson Jackson - Water/Sewer Superintendent
- Address: Pleasant View City Corporation
  520 West Elberta Drive
  Pleasant View City, Utah 84414
- Phone Number: (801) 782-8529

2.0 THE DELINEATION REPORT

The delineation report as required by UAC R309-600 was prepared by Hansen Allen & Luce, Inc., of Midvale City, Utah. Hansen Allen & Luce's report titled *Delineation Report Update Little Missouri Spring,, Pleasant View City, March 2015* is included in Appendix B.

"See Appendix B"

3.0 THE INVENTORY OF POTENTIAL CONTAMINATION SOURCES

This section addresses the process of inventorying the existing Potential Contamination Sources (PCS's) within the spring delineated protection zones. The contamination source inventory is accomplished through a two step approach; 1) Generation of an inventory of the potential contamination sources and 2) Prioritizing the potential contamination source inventory (PCSI) showing a ranking sequence from greatest potential to least potential of causing a contamination.

POTENTIAL CONTAMINATION SOURCE INVENTORY

This component of the PCS inventory involves the generation of a list of existing activities that have a potential of causing a contamination of the drinking water source. Such activities include the use, storage, transportation, or handling of chemicals that are detrimental to the quality of the drinking water. These activities may occur at businesses, warehouses, factories, underground storage tanks, agricultural operations, parks and lawns, septic tanks, private and public wells and private residences.

Personnel from Jones and Associates performed an aerial photograph, ownership plats, and an onsite inspection of the protection area and generated a complete listing of potential contamination sources. While performing the inspection, the name of each operation and the associated activity was determined. In addition, an inventory was made of any City owned facilities and a review was made of individual private residences. The land use activities within the recharge area was also noted. It was determined that not all of the identified activities present a danger to the ground-water around the spring. Many activities do not appear to use or store chemicals or conduct activity that could present a measurable danger to the quality of the ground-water.

The completed inventory list was studied to determine the activities that qualify as PCS's. The evaluation followed the guidelines set forth in the "Ground Water Source Protection Users Guide" by the Department of Environmental Quality, Division of Drinking Water (June 1, 2012). The Source Protection User's Guide provided a listing of activities which the State accepts as PCS's. This listing is included in **Appendix A**. The activity sources identified that were on the State's list of PCS's were selected as PCS's. Engineering judgement was also used to ensure that activities not mentioned on the State's list of PCS's were appropriately classified..

A summary listing of governmental agencies and their corresponding regulations currently in place for the protection of ground water is as shown in **Appendix A**. In general, these regulations protect the quality of ground water through the permitting and monitoring of potential contaminant sources, rather than the ground water itself. By restricting the type of contaminate, establishing maximum concentration levels, toxicity, treatment and discharge of potential contamination sources, the state and federal agencies are able to minimize the likelihood and severity of contamination.

3.1 LIST OF POTENTIAL CONTAMINATION SOURCES:

It should be noted that the majority of the protection area for the Little Missouri Spring consists of undeveloped hillside or agricultural areas. The protection area is within the Weber County and Pleasant View City Boundaries.

Table 3-1 lists the land use within the delineated protection zone, along with location, landowner's name, address, and phone number, where possible. **Appendix E** contains a list of property owner's names and contact information. **Appendix F** contains a list of well owner's names and contact information. Location maps of the listed properties and wells are also included in **Appendix E & F.**.

Table 3-1
Complete List of Potential PCSs

Id#	Activity	Zone 1	Zone 2	Zone 3	Zone 4	Address of PCS	Name, Address, Phone No. of Contact Person
1	Active & Abandoned Wells			X	X	As indicated on Map	See **Appendix F** for Well Ownership
2	Improved & Unimproved City Roadways			X		4300 North Street	Pleasant View City Corporation 520 West Elberta Drive Pleasant View City, UT 84414 (801) 782-8529
3	Residential Properties			X	X	As indicated on Map	See **Appendix E** for Property Ownership
4	Septic System/Drain Field				X	As shown on Map	John & Sandra Lott 4707 North 900 West Pleasant View City, UT 84414
5	Farmland and/or Livestock Properties			X	X	Located Throughout	See **Appendix E** for Property Ownership
6	Off-road Trails and Undeveloped Roadways			X	X	As indicated on Map	See **Appendix E** for Property Ownership
7	Private Roadways				X	As indicated on Map (Pole Patch Gated Community)	See **Appendix E** for Property Ownership (Roads maintained by Gated Community)
8	Private Sewer Lines				X	As shown on Map (Pole Patch Gated Community)	See **Appendix E** for Property Ownership (Sewers maintained by Gated Community)
9	Power Transmission Line Easement				X	As shown on Map	Rocky Mountain Power 1-888-221-7070

3.2 Identify Hazards

Identified activities and hazards associated with the PCS found in the DWSP area for the Little Missouri Spring, are listed in Table 3-2 as follows:

Table 3-2
Identification of PCS Hazards

ID #	Name of PCS	Identified Activity	PCS No.[a]	Identified Hazard[b]
1	Active & Abandoned Wells	Pumping water from aquifer and or groundwater source	1	Conduit for pollutants to reach groundwater source directly
2	Improved & Unimproved City Roadways	Motor Vehicle Accidents and Spills. De-Icing Salts and Chemicals.	39	Automobile Wastes[c], Construction Wasters, road salts and de-icing chemicals
3	Residential Properties	Residential Pesticide, Herbicide, and Fertilizer Storage, Use, Filling and Mixing Areas. Storage and repair of vehicles.	37	Common household products[d], Pesticides, Herbicides, and Fertilizers, Automobile wastes[c]
4	Septic System/Drain Field	Sewage collection and conveyance through drain field	44	Septage, Bacteria, Nitrates, Soaps, Oils, Bleach, Chemicals, Septic Tank Cleaner, etc.
5	Farmland and/or Livestock Properties	Agricultural operations or open space uses may use pesticides, herbicides, and natural (animal waste) or chemical fertilization. Animal grazing / livestock operations	2, 4	Livestock sewage wastes, nitrates, phosphates, chloride, bacteria. Pesticides, herbicides, and fertilizers
6	Off-road Trails and Undeveloped Roadways	Motor vehicle accidents and spills	39	Recreational Activity, Automobile Wastes[c]
7	Private Roadways	Motor Vehicle Accidents and Spills. De-Icing Salts and Chemicals.	39	Automobile Wastes[c], Construction Wasters, road salts and de-icing chemicals
8	Private Sewer Lines	Sewerage Collection and conveyance through sewer system.	43	Septage, Bacteria, Nitrates, Heavy Metals, Soaps, Oils, Bleach, Chemicals
9	Power Transmission Line Easement	Transmission line maintenance	39	Automobile Wastes[c], Construction Wastes

a - Chapter 5 of the most recent Source Protection User's Guide

b - Chemical, Biological, and Radiological substances used, stored, manufactured, transported, and disposed at the PCS which could contaminate water

c - "Automotive wastes can include gasoline, antifreeze, automatic transmission fluid, battery acid, engine and radiator flushes, engine and metal degreasers, hydraulic fluid, and motor oils" - from *Wellhead Protection: A Guide for Small Communities* - Published by the EPA 2/93

d- Common household products include: oven, drain, and toilet cleaners; disinfectants, metal polishes, jewelry cleaners, shoe polishes, synthetic detergents, bleach, stain and spot removers, solvents, caustic soda, paints, varnishes, stains, dyes, wood preservatives, paint thinners, floor and furniture strippers, automobile wastes[c], car wash detergents, car waxes and polishes, rock salt, refrigerants - Wellhead Protection: *A Guide for Small Communities* - Published by the EPA 2/93

3.3 Prioritize the Inventory

Following the completion of the field inventory work, the PCSs were evaluated as to the potential that each PCS had as a pollution contributor to the water source. The prioritization process is intended to rank the PCS's in order from those sources that may present the greatest risk to the drinking water source to those that present the least potential risk. The evaluation indicated that within the specified capture zones, that there are PCS's which have a probability or potential of contamination to the water supplies for the Little Missouri Spring.

The priority listing for the PCS's was accomplished through evaluation and discussions with the Pleasant View City Culinary Water Department and the engineering consultants. As the springs recharge area and the related PCS's are relatively few, simple and of low hazard; the best judgement of the Water Division and the consultants was used in establishing the priority ranking for each PCS. Based on this rational, the following provides a listing of all identified PCS's and a priority ranking for each source.

3.3.1 Evaluation

PCS ID #1 - Active & Abandoned Wells

Active and abandoned wells pose the potential for groundwater contamination. Should any type of contamination enter the pipe casing, the contamination could infiltrate the ground water aquifer and be collected downstream at the Spring.

PCS ID #2 - Improved and Unimproved City Roadways

Oil & Fuel & Chemical spills could get into the ground in an event of an accident, leaking from poorly maintained vehicles, or from being washed or dumped into the street by individual homeowners or inclement weather. Salts and De-Icing chemicals are regularly used during winter months. The accidental or improper use and disposal of chemicals, oils, fuels, salts, pesticides, fertilizers, etc. may be transported by the roadway surface into the storm drain system or open space areas.

PCS ID #3 - Residential Properties

Residential properties pose a potential for groundwater contamination. The improper use, storage, and disposal of chemicals, oils, herbicides, pesticides, and fertilizers may percolate into the ground water aquifer and be collected downstream at the Spring collection area. Agricultural activities on these properties could include livestock feeding and grazing which may produce limited amounts of manure.

PCS ID #4 - Septic System/Drain Field

Discharges from septic tank/drain field systems provide a direct discharge of highly contaminated wastewater into the potential ground water recharge areas.

Currently the Utah State Code requires that any residence within 300 feet of an existing sanitary sewer system can be required to make connection to the existing sewer system. However, the existing sewer system is beyond 300 feet and there are no immediate plans to extend the sewer system to service this area. The construction and location of septic tank systems is regulated by the local health department, but there are no controls to regulate disposal into the septic system.

PCS ID #5 - Farmland and/or Livestock Properties

Agricultural farming operations present a potential for contamination to the Spring. To our knowledge, the

owners of the farmlands within the spring recharge area do not use pesticides, herbicides, or chemical fertilizers; however, there is always the possibility that these property owners could use these contamination products in the future.

Animal grazing presents another potential contamination source to the Spring. Livestock grazing produces limited amounts of manure on the grazing area. Manure could be carried by surface drainage into the surrounding creeks or drainage areas. These collected contaminates could become concentrated and eventually percolate into the ground water aquifer which is tributary to the spring.

Adjacent to the agricultural properties, are significant areas of undeveloped open hillside areas. These properties have very little potential for ground water contamination. Many of the open space properties are held in ownership by the same property owners who are farm land operators; therefore, we have listed both the open space property owners and the farmland owners together under the potential contamination listing. Should these private owners ever desire to develop their property, then the related development facilities would need to be carefully evaluated at that time. There is public and private sanitary sewer system in only a small portion of the spring recharge area; therefore, it would be important that management plans be in place prior to development which would prohibit the use of septic tank waste disposal systems anywhere in the recharge area.

PCS ID #6 - Off-road Trails and Undeveloped Roadways

Due to private property access, the terrain and type of recreational activity, Oil & Fuel spills could only get in the ground in the event of an accident. Unless the fuel or oil spill is concentrated in an area close to the springs, this should not pose a significant potential for contamination to the Spring.

PCS ID #7 - Private Roadways

Oil & Fuel & Chemical spills could get into the ground in an event of an accident, leaking from poorly maintained vehicles, or from being washed or dumped into the street by construction activities, individual homeowners, or inclement weather. Salts and De-Icing chemicals are regularly used during winter months. The accidental or improper use and disposal of chemicals, oils, fuels, salts, pesticides, fertilizers, etc. may be transported by the roadway surface into the storm drain system or open space areas.

PCS ID #8 - Private Sewer Lines

Sewage collection and conveyance through sewer system. Even well-operated systems may be subject to occasional blockages or structural or mechanical failures. Sanitary sewer overflows occur when untreated sewage is discharged from the collection system due to pipe blockages, pipe breaks, infiltration and inflow from leaky pipes, equipment failures, and insufficient system capacity. The untreated sewage can percolate through the soil and contaminate the ground water. Visual inspections, monitoring and maintenance programs, operator training, and public education will help prevent contamination to drinking water sources.

PCS ID #9 - Power Transmission Line

Power transmission line construction and maintenance necessitates the use of heavy equipment and associated fuels, lubricants, coolants, solvents, and other potentially hazardous substances that, if spilled, could affect shallow groundwater and/or unconsolidated aquifers. Accidental spills or leaks of hazardous materials associated with vehicle fueling, vehicle maintenance, and material storage would present a potential contamination threat to groundwater resources. Soil contamination resulting from these spills or leaks could continue to add pollutants to the groundwater long after the spill has occurred.

While contaminants have a potential of ground water infiltration, the safety controls used by the company and the minimal required maintenance at the site make this a low hazard in terms of contamination potential for the Spring.

3.3.2 Priority Ranking

A semi-quantitative approach was used to assign a numerical risk value to and develop a prioritized ranking for each PCS. The following factors were considered in the assignment of numerical risk value: (1) the estimated distance from the PCS to the springs; (2) the estimated volume of the hazard present at the PCS; and (3) the presence and degree of controls in place at the PCS which would prevent accidental spills. In general, it was assumed that:

- PCSs located closer to the drinking water sources represent a greater risk than PCSs located farther away.
- PCSs with a greater volume of a hazard represent a greater risk than PCSs with a smaller volume of a hazard.
- PCSs with no controls represent a greater risk than PCSs with controls.

It was further assumed that distance represents 34 percent and volume and presence and degree of controls each represent 33 percent of the total risk.

The total relative risk was calculated for each PCS using the following equation:

R=D+V+P; where,
R= Total relative risk
D= Distance from PCS to the drinking water source,
V= Volume of hazard present at the PCS, and
P= Presence and degree of controls present at the PCS.

Points for distance (D), volume (V), and controls (P) were assigned as follows:

- **Distance to Drinking Water Source (D) = 34%**
  - DWSP Zone 1 = 34 points
  - DWSP Zone 2 = 25 points
  - DWSP Zone 3 = 17 points
  - DWSP Zone4 = 8 points

- **Volume of Hazard (V) 33%**
  - more than 500 gallons = 33 points
  - 50 to 500 gallons = 22 points
  - less than 50 gallons = 11 points

- **Presence and Degree of Regulatory Control (P) = 33%**
  - No controls = 33 points
  - Some controls = 22 points
  - Full controls = 11 points

Professional judgement, as recommended by the DDW (2012) in the *Source Protection User's Guide*, was also used, as appropriate, if two or more PCSs were assigned the same number of points for total relative risk. Factors considered in using professional judgement included, but not limited to: (1) the chemical, physical, and toxicological properties of the hazard present at the PCS; and (2) the type of control present. Hazards that are characterized as soluble, persistent, mobile, and toxic or carcinogenic were considered to represent a greater relative risk than hazards that are not characterized as such. PCSs without regulatory controls were considered to represent a greater risk than PCSs with regulatory controls.

The following tables list the PCS priority order for the Pleasant View City Little Missouri Spring:

Table 3-3
Prioritized List of PCSs For
Little Missouri Spring

Rank	ID#	Name of PCS	*RISK POINTS*			
			Distance To Springs (34%)	Volume of Hazard (33%)	Controls in Place (33%)	Total Risk Points
1	5	Farmland and/or Livestock Properties	17	22	33	72
2	4	Septic System/Drain Field	8	22	33	63
3	8	Private Sewer Lines	8	22	33	63
4	3	Residential Properties	17	11	22	50
5	1	Active & Abandoned Wells	17	11	22	50
6	2	Improved & Unimproved City Roadways	17	11	22	50
7	6	Off-road Trails and Undeveloped Roadways	17	11	22	50
8	7	Private Roadways	8	11	22	41
9	9	Power Transmission Line Easement	8	11	11	30

3.4 PCS Location

Table 3-1 describes each PCS as to its location in Zone one, two, three, or four. Please refer to this table. The ID# in table 3.1 refers to the number assigned each PCS. This number can be used to locate the PCS on the Location Map.

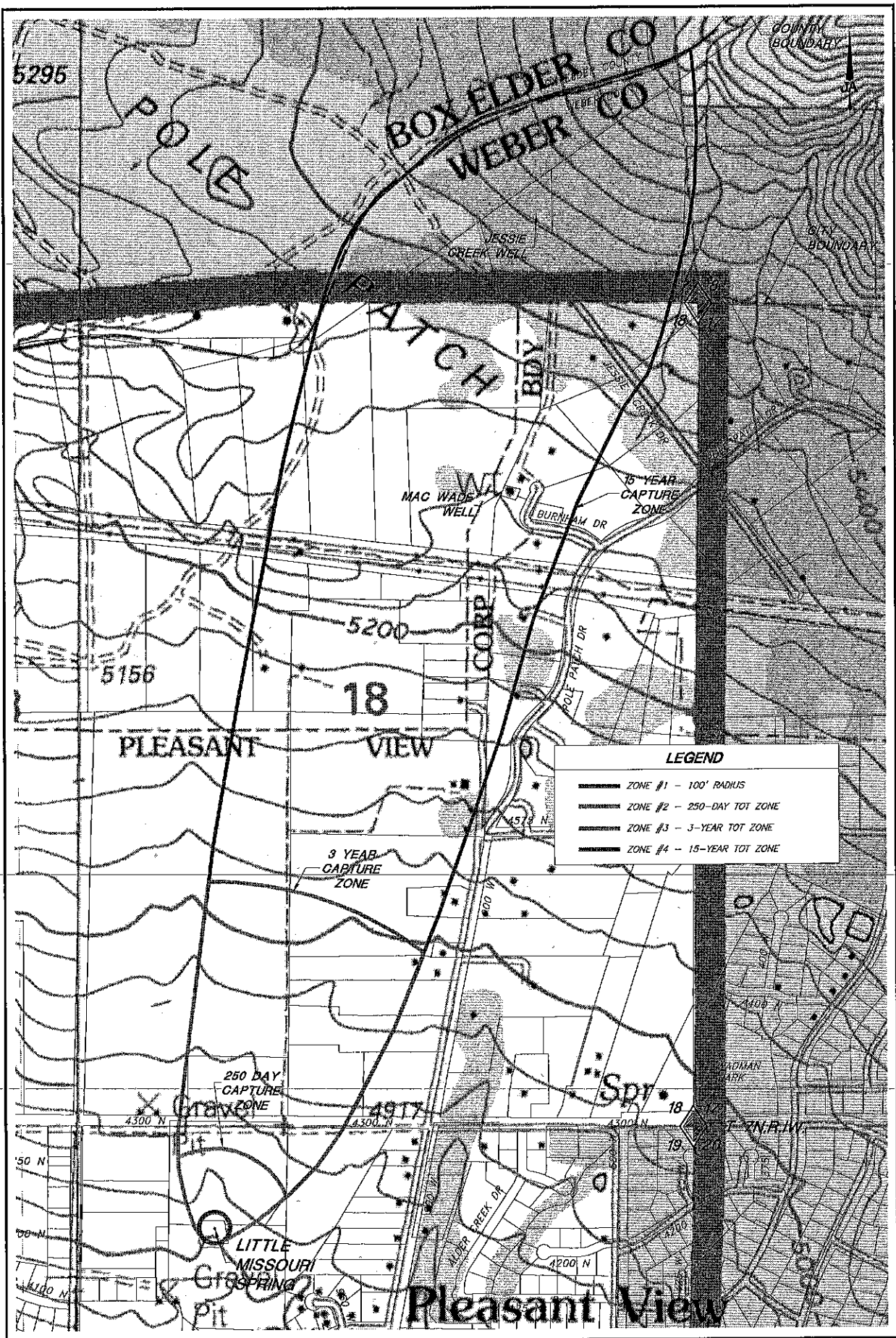
3.5 PCS Plotted on Map

PCS Location Map including delineation zones attached on following page:

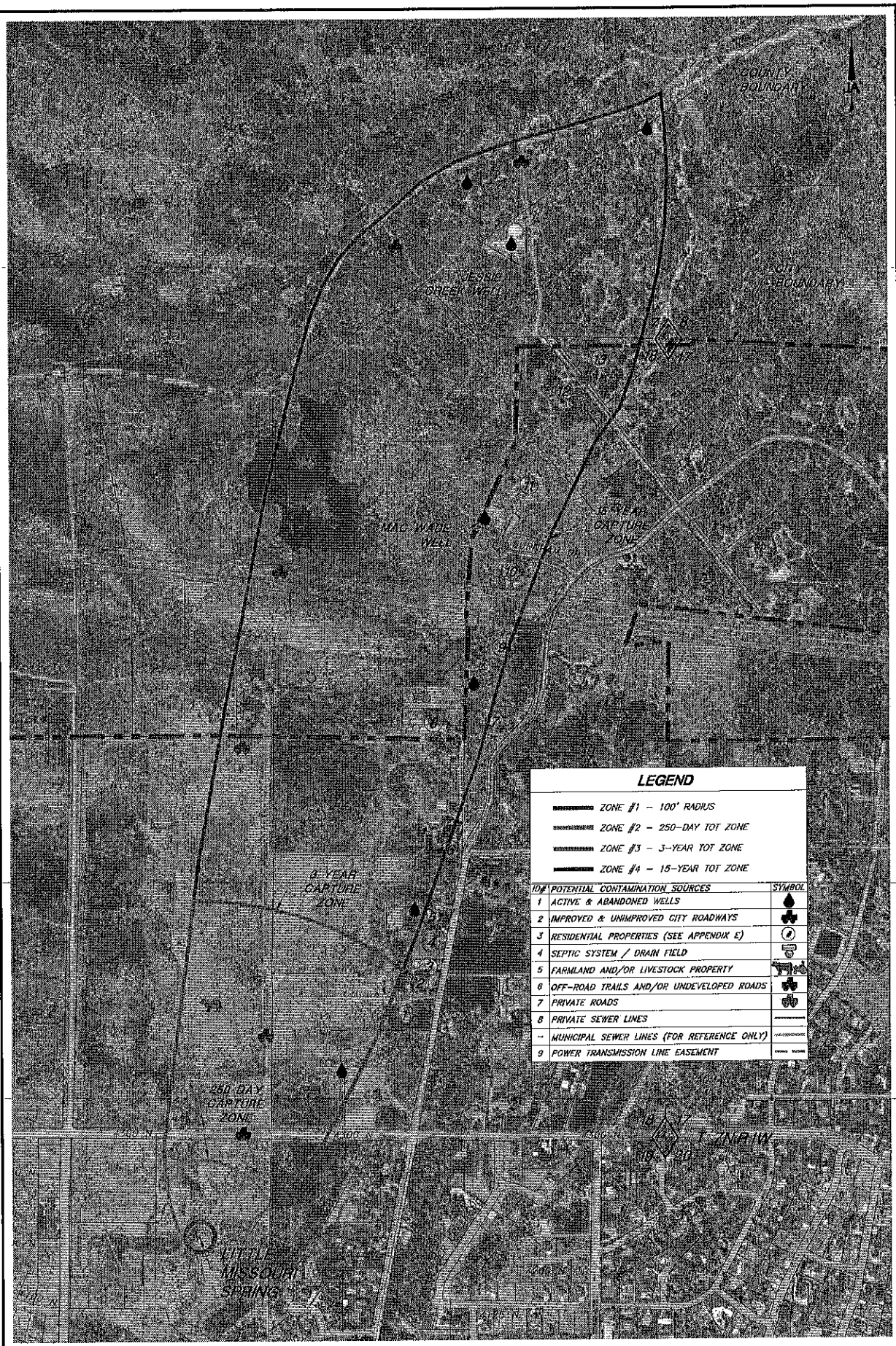
Map

LITTLE MISSOURI SPRING
DWSP

MAPS



PROJECT ENGINEER DATE	SCALE: N.T.S.	DESIGNED DRAWN CHECKED	JONES & ASSOCIATES	CONSULTING ENGINEERS 1716 East 5600 South South Ogden, Utah 84403 (801) 476-9767	PLEASANT VIEW CITY CORPORATION LITTLE MISSOURI SPRING DWSP USGS MAP	SHEET 1 OF 3 SHEETS



PROJECT ENGINEER

DATE

SCALE: N.T.S.

DESIGNED

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CHECKED

JA JONES & ASSOCIATES

CONSULTING ENGINEERS
1716 East 5600 South
South Ogden, Utah 84403
(801) 476-9767

PLEASANT VIEW CITY CORPORATION

LITTLE MISSOURI SPRING DWSP

PCS MAP

SHEET: 2 OF 3 SHEETS

4.0 THE ASSESSMENT OF POTENTIAL CONTAMINATION SOURCE HAZARDS

This section presents the assessment of potential contamination source (PCS) hazards for the Pleasant View City Little Missouri Spring.

Four types of hazard controls are recognized in DDW guidance for PCSs: **1) regulatory, 2) best management/pollution prevention, 3) physical, and 4) negligible quantity controls.** Identified hazards were assessed as *adequately controlled* or *not adequately controlled*. Each potential contamination hazard for the four protection areas are discussed in the following sections. General Guidelines to assess the controls present at each PCS were as follows:

Control Type	Description	Procedure
Regulatory Controls	Regulatory Controls are codes, ordinances, rules, and regulations which regulate a PCS hazard.	1. Identify the enforcement agency. 2. Cite and/or quote applicable references in the regulation, rule or ordinance which pertain to controlling the hazard. 3. Explain how the regulatory controls affect the potential for ground water contamination. 4. Verify that the hazard is being regulated by the enforcement agency. 5. Assess the hazard as "Adequately Controlled" or "Not Adequately Controlled" and set a date to reassess the hazard.
Best Management Practices (BMPs)	BMPs include practices and procedures currently being used by the PCS to control a PCS hazard.	1. List the specific BMP's which have been implemented by the PCS management to control the hazard. 2. Indicate that the PCS is willing to continue the use of these BMP's. 3. Explain how these BMP's affect the potential for ground water contamination. 4. Assess the hazard as "Adequately Controlled" or "Not Adequately Controlled" and set a date to reassess the hazard.
Physical Controls	Physical Controls are man-made structures and impoundments which prevent a hazard from entering the drinking water source.	1. Describe the physical controls which have been constructed to control the hazard. 2. Explain how these controls affect the potential for contamination. 3. Assess the hazard as "Adequately Controlled" or "Not Adequately Controlled" and set a date to reassess the hazard.
Negligible Quantity Controls	Negligible Quantity Controls relate to the amount or toxicity of a hazard that is used by a PCS. The control deals with the risk of contamination and determining whether the risk is negligible or not significant enough to warrant further management.	1. Identify the quantity of the hazard that is being used, disposed, stored, manufactured, and/or transported. 2. Explain why this amount is a negligible quantity. 3. Assess the hazard as "Adequately Controlled" or "Not Adequately Controlled" and set a date to reassess the hazard.

- As per UAC R309-113-10, a source was assessed to be "*adequately controlled*" if the "*...current controls are stringent enough to prevent pollution from a potential contamination source from reaching a ground-water source of drinking water.*" This section of UAC R309-113 further states that the "*...DDW will consider a PWS's assessment that a potential contamination source which is covered by a permit or approval under one of the regulatory programs listed below sufficient to demonstrate that the source is adequately controlled unless otherwise determined by the Executive Secretary .*" A PCS was characterized as "*adequately controlled*" if it was found to be regulated by one of the programs identified in UAC R309-113-10.

- In the case where more than one control exists, only one control was listed, as recommended in the *Source Protection User's Guide.*

- All water wells which were reported to be grouted in accordance with DWR and DDW regulations were assessed to be "*adequately controlled.*"

- As per the recommendation of the *Source Protection User's Guide*, all septic systems, animal feeding areas (over ten units), and manure piles were assessed to be "*not adequately controlled.*"

- Reassessment of Hazards has been set with the DDW requirement for updating DWSP Plans. The next update year deadline for the City's springs is December 31, 2017.

The identified controls for each PCS hazard assessed for Little Missouri Spring are listed in table 4-1:

Table 4-1
PCS Hazard Controls

ID #	Name of Actual PCS	Controls	Enforcement Agency or Contact	Control is Adequate or Not Adequate	Date to Reassess Hazard
1	Active & Abandoned Wells	**Regulatory:** UAC R655-4 Water Well Rule UAC R655-4-12 Abandoned Wells	Utah Division of Water Rights P.O. Box 144830 Salt Lake City, UT 84114 (801) 536-4197	Not Adequate	2017
		Adding Physical controls will restrict the possibility of contaminants reaching the ground water. (Seals, Capping, etc.)	Individual Owners Contact Information listed in **Appendix F.**	*City Wells are Adequate*	

Table 4-1
PCS Hazard Controls

ID #	Name of Actual PCS	Controls	Enforcement Agency or Contact	Control is Adequate or Not Adequate	Date to Reassess Hazard
2	Improved & Unimproved City Roadways	**Best Management and Pollution Prevention Practices:** Thru routine inspection and maintenance and storm drain cleaning schedule. *Adding physical controls will restrict the possibility of contaminants reaching the ground water. (Curb & Gutter, Storm Drain System, etc.)*	Pleasant View City 520 West Elberta Drive Pleasant View City, UT 84414 (801) 782-8529	Not Adequate	2017
3	Residential Properties	**Best Management and Pollution Prevention Practices:** by individual owners as to the proper storage, use, and disposal of chemicals, oils, fuels, salts, hazardous wastes, etc stored or used on site.	Individual Owners Contact Information listed in **Appendix E** Weber-Morgan Health Dept. 477 23rd Street Ogden, Utah 84401	Not Adequate	2017
4	Septic System / Drain Field	**Regulatory:** UAC R317, Individual Wastewater Disposal Systems *Utah State Code requires any residence within 300 feet of an existing sanitary sewer system to make connection to the existing system (Utah Code 10-8-38)*	Weber-Morgan Health Dept. 477 23rd Street Ogden, Utah 84401 John & Sandra Lott 4707 North 900 West Pleasant View City, UT 84414	Not Adequate	2017
5	Farmland and / or Livestock Properties	**Best Management Practices:** by individual Owners as to storage, use, and disposal of hazardous substances.	Utah Department of Agriculture and Food P.O. Box 146500 Salt Lake City, UT 84114-6500 (801) 538-7100 Individual Owners Contact Information listed in **Appendix E**	Not Adequate	2017

Table 4-1
PCS Hazard Controls

ID #	Name of Actual PCS	Controls	Enforcement Agency or Contact	Control is Adequate or Not Adequate	Date to Reassess Hazard
6	Off-road Trails and Undeveloped Roadways	**Negligible Quantities:** Limited Access to area - Private Property. Quantities of Contaminants are limited to small off-road vehicles.	Individual Owners Contact Information listed in **Appendix E.**	Adequate	2017
7	Private Roadways	**Physical Controls:** Gated Community - Limited Access by PCSs	Individual Owners Contact Information listed in **Appendix E.** (Pole Patch Subdivision)	Not Adequate	2017
8	Private Sewer Lines	**Best Management and Pollution Prevention Practices:** Thru routine inspection and maintenance schedule. R309-515-6 Guidelines for sewer line construction within DWSP Zones	Individual Owners Contact Information listed in **Appendix E.** (Pole Patch Subdivision)	Not Adequate	2017
9	Power Transmission Line Easement	**Best Management and Pollution Prevention Practices:** Power line safety protocol will protect ground water.	Rocky Mountain Power 1-888-221-7070	Adequate	2017

5.0 MANAGEMENT PROGRAM FOR EXISTING POTENTIAL CONTAMINATION SOURCES

Land management, management practices or pollution prevention strategies must be implemented for any of the potential contamination sources that have been determined as *not adequately controlled.* Table 5-1 presents land management strategies for PCSs that were assessed as *not adequately controlled* in Section 4.0, and summarizes the management strategies that are proposed by the Pleasant View City Corporation to address these hazards.

Preparation of the management program affords the City the opportunity to review and evaluate the adequacy of existing regulations and programs in regard to their adequate protection to the City to implement additional regulations and/or land use restrictions as necessary for protection of this vital resource.

5.1 Plan Land Management Strategies

The effectiveness of any management program is limited to legal jurisdiction of the owner of the spring, the manpower and resources needed for enforcement and the cooperation of land owners within the drinking water source protection zones. Management strategies are generally classified and regulatory and non-regulatory.

Regulatory controls are those which require legal authority and generally legislation action such as quality standards, zoning ordinances, subdivision review, design standards, etc. Over the years, a number of regulations have been implemented on both the State and Federal level in an effort to protect the ground water. A summary listing of the regulations currently in place for the protection of groundwater is listed in **Appendix A**. In general, these regulations protect the quality of ground water through the permitting and monitoring of potential contaminant concentration levels, toxicity, treatment and discharge of potential contamination sources, the state and federal agencies are able to minimize the likelihood and severity of contamination as previously presented in the contamination source inventory section.

Non-regulatory land management strategies will be implemented to control existing PCSs. Non-regulatory controls include strategies such as public education, written contract agreements, water conservation programs, and best management and pollution prevention practices. A public education strategy will be used to make residents aware of the importance of properly controlling their wastes that could potentially contaminate the groundwater. Property owners and Well owners listed in **Appendix E & F** will be notified by a letter from the City, stating that their property or well is located in a public drinking water protection zone and that groundwater could become contaminated if hazardous substances are not used, stored, and disposed of properly. The letter will state that fact sheets have been enclosed. (Include the applicable fact sheets found in **Appendix D**.) The letter should request that the residents take time to review and the enclosed fact sheets and follow the management practices suggested. A similar letter with any updated fact sheets will be sent to each property owner on an annual basis.

Table 5-1
Management Strategies for existing PCSs
Assessed as *Not Adequately Controlled*

ID #	Name of Actual PCS	Identified Hazard	Management Strategy
1	Active & Abandoned Wells	Improper use and maintenance may allow contaminants to enter the aquifer directly. *(City Owned Wells are Adequately Controlled)*	Annually prepare and distribute an informational letter to all the well owners located within the Spring DWSP zones. This letter will: (1) inform the operators of their location within the recharge areas of the springs that supply the City with drinking water; (2) request that they take an active role in protecting their own and the City's drinking water sources through the proper storage, use, and disposal of hazardous chemicals; (3) and request they follow State guidelines for the upkeep (sealing, etc.) or abandonment of their well. The status of each well should be checked and documented. Recommend that insecticides, herbicides, and fertilizers not be applied within 100 feet of an existing well.
2	Improved & Unimproved City Roadways	Motor vehicle chemicals, de-icing salts and chemicals.	Install curb and gutter and a storm drain system along 4300 North Street and on any future developed roadway within the Delineated Protection Zones..
3	Residential Properties	Variety of Potential Contaminants based on land use. Construction, Agricultural, and home-use Contaminants.	Annually prepare and distribute an informational letter to all the residential property owners located within the Spring DWSP zones. This letter will: (1) inform the owners of their location within the recharge areas of the springs that supply the City with drinking water; (2) outline the need for contamination control in this zone; (3) and provide a list of helpful management practices which would assist in the control of contamination to the ground water supply. Include recommendations on the proper use, storage and disposal hazardous chemicals, and BMP's for agricultural or construction activities. The letter will also request that the City Public Works Department be notified of any accidents or spills that occur within this zone.
4	Septic System / Drain Field	Discharges from septic tank systems provide a direct discharge of highly contaminated wastewater into potential ground water recharge areas.	Annually prepare and distribute an informational letter to all septic tank owners located within the Spring DWSP zones. This letter will: (1) inform the operators of their location within the recharge areas of the springs that supply the City with drinking water; (2) request that they do not use septic tank cleaners or dispose of hazardous materials in the septic system; (3) and that they follow the local Health Department guidelines for the upkeep and maintenance of septic systems. Pleasant View City will require that any future developments be required to connect to the Sewer System.

Table 5-1
Management Strategies for existing PCSs
Assessed as *Not Adequately Controlled*

ID #	Name of Actual PCS	Identified Hazard	Management Strategy
5	Farmland and / or Livestock Properties	Livestock sewage wastes, Pesticides, herbicides, and fertilizers.	Annually prepare and distribute an informational letter to all the open space, farmland, or livestock owners located within the Spring DWSP zones. This letter will: (1) inform the owners of their location within the recharge areas of the springs that supply the City with drinking water; (2) outline the need for contamination control in this zone; (3) and provide a list of helpful management practices which would assist in the control of contamination to the ground water supply. Include recommendations on the proper use, storage and disposal hazardous chemicals, and BMP's for agricultural or construction activities. The letter will also request that the City Public Works Department be notified of any accidents or spills that occur within this zone.
7	Private Roadways	Hydrocarbons from fuels, oil, hydraulic fluid, antifreeze fluids, road salts and de-icing chemicals.	Annually prepare and deliver a letter to the Pole Patch Home Owners Association. This letter will: (1) inform the Association of their location within the recharge areas of the wells and springs which provides them drinking water; (2) request that they take an active roles in protecting their drinking water through the proper and safe use of materials, chemicals, and equipment within the DWSP Zones; (3) monitor PCSs access to their gated community; (4) and request that Pleasant View City Corporation be notified of any accidents or hazardous waste spills that occur within each zone.
8	Private Sewer Lines	Sewerage Collection and conveyance through sewer system.	Annually prepare and deliver a letter to the Pole Patch Home Owners Association. This letter will: (1) inform the Association of their location within the recharge areas of the wells and springs which provides them drinking water; (2) request that they take an active roles in protecting their drinking water through the proper and safe use of materials, chemicals, and equipment within the DWSP Zones; (3) outline specific BMP's and routine maintenance and inspection of the private sewer line; (4) request that they follow Rule 309-515-6 (Guidelines for sewer construction within DWSP Zones) on any line construction/repair; (5) and request that Pleasant View City Corporation be notified of any waste spills or leaks that occur within each zone.

5.2 Discussion - BMP

Best management and pollution prevention are part of the land strategy methods that were addressed in Section 5.1 and Table 5-1. Best land management and pollution prevention strategies for residential dwelling PCSs are presented in the form of fact sheets that will be sent by mail to each of the PCSs. These fact sheets are found in **Appendix D.**

ID#	PCS	Management Strategy Summary										
		A	B	C	DE		F	G	H	I	J	K
1	Active & Abandoned Wells	X	X	X		X	X				X	
2	Improved & Unimproved City Roadways	X										X
3	Residential Properties	X	X	X	X						X	
4	Septic System / Drain Field	X	X	X					X	X	X	
5	Farmland and / or Livestock Properties	X	X	X	X						X	
6	Off-road Trails and Undeveloped Roadways	X										
7	Private Roadways	X	X	X							X	
8	Private Sewer Lines	X	X	X				X			X	X
9	Power Transmission Line Easement	X	Optional									

Legend of Management Strategies	
A	Inform the PCS that they are within a DWSP zone. All Potential Contaminant Sources (PCS's) will be informed that they are in a DWSP zone and request that the owner notify the City in the event of a leak or spill.
B	Annually send mailer and/or information packet. The mailer will also go to all contaminant sources (Does not include City owned PCS's). This should include any information that may help the individual/business/property owner to know what good and bad practices are in a DWSP zone and how to manage potential contaminant sources. It should outline specific BMP's; request proper application, storage, and disposal of chemicals; and request that residents do not dispose of toxic or hazardous wastes into the Storm Drain System.
C	Request use and handling of chemicals in accordance with manufacturer's recommendations and MSDS requirements. Annually or as needed, send a mailer to all residents/property owners regarding proper storing and/or disposal of chemicals. Inform of proper chemical application practices and request compliance.
D	Request that all chemicals and containers be stored indoors on impervious surfaces. Request that secondary containment be provided for all containers over 55 gallons in capacity.
E	Maintain permanent record of location of all active and abandoned wells. The location of this well is documented in this report on the PCS location map.
F	Check to see if abandoned or active wells are properly sealed or capped. IF the wells are not properly sealed or capped per state standards, pursue proper sealing or capping of each well. Contact with each well owner should be made to determine the status of each well. After the status of the well is determined, the proper course of action may be taken.

G	Establish routine maintenance, inspection, and replacement plan for sewer lines.
H	Encourage septic system owners to connect to future sewer system, if and when one becomes available.
I	Request PCS to not use septic cleaners, and follow the local Health department regulations for septic systems.
J	Request the PCS implement best management practices for the identified hazards as outlined in **Appendix D.**
K	Annually hold an employee training seminar. Train those involved in source protection.

6.0 THE MANAGEMENT PROGRAM FOR FUTURE POTENTIAL CONTAMINATION SOURCES

The DWSP Rule (UAC R113-12) requires that a program be established to manage potential contamination sources (PCSs) that, in the future, may want to locate within the Little Missouri Spring DWSP zones. Some of these future PCSs may be similar to existing PCSs, or they may present hazards that were previously not encountered.

6.1 Management Program for Future PCSs

As currently written, the Drinking Water Source Protection Rule requires management strategies for each of the DWSP delineation zones as follows:

1. 100-foot radius form the spring source **(Zone 1):** Prohibits the placement of future PCS's within this zone.

2. 250-day ground water travel zone **(Zone 2):** Prohibits the location of future PCS's unless all potential contamination discharges are controlled using acceptable design methods.

3. 3-year ground water travel time **(Zone 3):** Prohibits future PCS's which contain volatile organic chemicals (VOC's) or certain pesticides.

4. 15-year ground water travel zone **(Zone 4):** Prohibits the location of PCS's not controlled through land management strategies.

Pleasant View City Corporation will develop a proactive management program with specific procedures to identify, assess, control, and in some cases prohibit future PCSs that are proposed to be located within the DWSP zones for their drinking water sources. This program consists of two parts as follows:

- Part 1- Management program for the Zone One DWSP areas; and
- Part 2- Management program for the Zone Two, Three, and Four DWSP areas.

Part 1- Management Program for the Zone One DWSP Areas

The Zone One DWSP area is defined by UAC R309-113 as a 100-foot radius around the drinking water source. The management of future PCSs within Zone 1 will be controlled by Pleasant View City. The Little Missouri spring is located on City owned land. The City will prohibit any future contamination anywhere on property owned and controlled by the City. Pleasant View City Corporation will take all necessary steps to ensure that Zone one for the sources is protected. The spring collection area is fenced.

Part 2- Management Program for the Zone Two, Three, and Four DWSP Areas

The "Spring Recharge Area" was defined for the Little Missouri Spring using computer modeling and is shown, together with the PCSs, on the PCS Map. As part of the management program for future PCSs located within these DWSP zones, Pleasant View City Culinary Water Department will:

- Identify and contact each new *possible* PCS as it locates within the DWSP zones;
- Determine whether a new facility is an *actual* PCS;
- If the facility is an *actual* PCS, then add it to the inventory of *actual* PCSs;
- Identify and assess the controls planned by the PCS; and
- Plan and implement land management strategies for the PCS if not adequately controlled.

The management strategies for Zones 2, 3, and 4 will be implemented by the Pleasant View City through a

combination of both existing and proposed regulatory and non-regulatory measures. In addition to the current State and Federal Regulations identified in Table 1 in **Appendix A**, the following regulatory measures which will be adopted by Pleasant View City Corporation.

1. The City will adopt and enforce an ordinance patterned after the example "Source Protection Ordinance" as contained in the draft "Source Protection User's Guide" (DDW, 1995) for protection of their ground water resources, and will enact zoning to support the Source Protection Ordinance. This ordinance applies to all PCSs and properties within City boundaries. **(Completed - March 26th 2002 See Appendix C)**

   A portion of the DWSP Zones for the drinking water sources is located within the corporate boundary of Pleasant View City. Since Pleasant View City currently has a DWSP Ordinance in force, future PCSs on this land will be controlled using the ordinance. This ordinance prohibits the location of PCSs within Zone 1 unless they are controlled with design standards; prohibits the location of pollution sources within Zone 2 unless their contaminated discharges are controlled with design standards; and prohibits the location of PCSs whin DWSP Zones 3 and 4 unless they are controlled through land management strategies.

2. The City will petition Weber County and Box Elder County to adopt an ordinance patterned after the example "Source Protection Ordinance" as contained in the draft "Source Protection User's Guide" (DDW, 1995) for the protection of their ground water resources, and to enact zoning to support the Source Protection Ordinance. These ordinances apply to all PCSs and properties outside of the Pleasant View City boundary. **(Completed - See Appendix C)**

3. New *possible* PCSs located in the protections zones will be identified through: (1) Development reviews and approvals by the City, and (2) periodic reconnaissance by City personnel of DWSP zones to identify new *possible* PCSs or other activities within the DWSP zones that could impact groundwater quality. Each new *possible* PCS will be (a) contacted, advised that they are located within a DWSP zone, (b) controls will be assessed to determine if the potential contamination is allowed or adequately controlled or not, and ('c) if controls are not adequate, best management practices will be evaluated and put in place. **(Ongoing)**

4. Pleasant View City Corporation will annually update the PCS inventory, adding new PCSs and modifying any outdated information for existing PCSs. As discussed in section 5.1 and Table 5-1, public education information in the form of fact sheets will be sent on an annual basis to each PCS. New PCSs will be added to the annual mailing list. **(Ongoing)**

5. Any new residential/commercial/industrial developments proposed within a defined drinking water source protection zone will be subject to a special City staff review and said development will not be recommended for Planning Commission approval until their plans include all necessary special designs, controls and procedures required to protect against ground water contamination. **(New)**

7.0 THE IMPLEMENTATION SCHEDULE

The implementation schedule basically outlines the dates when Pleasant View City Corporation will implement the land management strategies which have been addressed in this DWSP. Each potential contamination source listed on the PCS inventory and assessed as *not adequately controlled* must implement land management strategies that have been identified to control future potential contamination sources. Land management strategies will be implemented according to this schedule. Table 7-1 outlines the Pleasant View City DWSP implementation schedule.

Table 7-1
Implementation Schedule for Management of Existing PCS's

Strategy	Description	Implementation Date	Frequency	Comments	Current Status
A	Inform the PCS that they are within a DWSP zone.	June 2002	Repeat for new PCS's	Emphasize need for cooperation	Ongoing
B	Annually send mailer and/or information packet.	January 2003	Annually	Remind PCS's that they are in a DWSP zone	Ongoing
C	Request use and handling of chemicals in accordance with manufacturer's recommendations and MSDS requirements.	January 2003	Annually	Include in Annual Information Packet	Ongoing
D	Request that all chemicals and containers be stored indoors on impervious surfaces. Request that secondary containment be provided for all containers over 55 gallons in capacity.	January 2003	Annually	Include in Annual Information Packet	Ongoing
E	Maintain permanent record of location of all active and abandoned wells.	October 2010	Update Every 6 Years	Included in this report	Complete
F	Check to see if abandoned or active wells are properly sealed or capped.	October 2010	One time issue	Inspect each Well for compliance	Ongoing
G	Establish routine maintenance, inspection, and replacement plan for sewer lines.	December 2009	One Time Issue	Educate and assist Pole Patch in creating management plan	Ongoing
H	Encourage septic system owners to connect to future sewer system, if and when one becomes available.	January 2003	Annually	Include in Annual Information Packet	Ongoing

I	Request PCS to not use septic cleaners, and follow the local Health department regulations for septic systems.	January 2003	Annually	Include in Annual Information Packet	Ongoing
J	Request the PCS implement best management practices for the identified hazards as outlined in **Appendix D**.	January 2003	Annually	Include in Annual Information Packet	Ongoing
K	Annually hold a management training seminar..	December 2009	Annually	Train those involved in Source Protection	Ongoing

8.0 THE RESOURCE EVALUATION

Pleasant View City is a municipally-owned and operated, community public drinking system managed by Tyson Jackson and under the guidance of an assigned City Councilperson. Rates for water service are set by the Pleasant View City Council. These rates are set so as to assure the utility of a reasonable rate of return and funding adequate to handle operational costs. Pleasant View City has qualified and trained personnel, including state-certified operators handling the day-to-day operations.

The DWSP plan will be administered by the Pleasant View City Staff. Implementation of the DWSP plans will not require extensive human resources. Because there are few existing PCSs, it is anticipated that the time required by management to meet the implementation resource requirements will be negligible. All funds necessary for implementation and continued support for the Drinking Water Source Protection Plan Rule will be derived from the City Culinary Water Budget.

9.0 THE RECORD KEEPING SECTION

The information contained in this section of the update report corresponds with the items listed in the Management Strategies Sections (5.0 and 6.0) and the Implementation Schedule Section (7.0) of the original report. Much of the record keeping itself is contained in the original reports. Other documentation of correspondence and actions taken with relation to the DWSP plan are contained in **Appendix H.**

9.1 Documentation

See documents included in **Appendix H.**

9.2 Record Keeping Files

The Source Protection Program requires that the public drinking water system keep accurate, continuous records to show current conditions in the protection zones and management areas. As such Pleasant View City Culinary Water Department will set up and maintain a Source Protection Document File set up as follows:

Little Missouri Spring – Source Protection Files

1. Copy of the Pleasant View City - *Drinking Water Source Protection Zone Delineation Report Update for Little Missouri Spring,* by Hansen Allen & Luce, Inc.

2. Copy of Jones & Associates Report on Contaminate Source Inventory, Management Plans, Implementation Schedule, Resource Evaluation, and Record Keeping. (This Report)

3. Copy of any City or County Source Protection Ordinances, notes, meeting minutes

4. Names and Addresses of all present Potential Contamination Sources

5. Copies of letters and mailers sent to Potential Source Contaminate individuals as required under the management strategies and implementation schedule. Provide dates when letters and mailers were mailed.

6. General Correspondence, memos, letters, permits, training sessions, etc.

7. Changes in Potential Source Contaminate Sources:
   a. Changes in Potential Source Type
   b. Changes in land ownership
   c. Any new management strategies

8. Six Year Report and Update to the State Division of Drinking Water

9. Original Source Protection Document and any other Updated copies on file.

As listed above, the Pleasant View City Culinary Water Department will report to the State Division of Drinking Water every six (6) years and will submit an update which will present the current status of all ordinances and any changes in the potential contamination sources.

10.0 THE CONTINGENCY PLAN

10.1 Introduction

According to the DDW:

> Contingency Plans should focus on the identification and possible solution of problems that may arise in the event that the Drinking Water Source Protection (DWSP) Plan fails. Additionally, Contingency Plans address problems public water systems (PWSs) need to solve in the event of water shortages or contamination incidents that may impact their ability to supply safe drinking water to the public. Contingency planning includes emergency response, rationing, remediation, and new source development plans. Prior planning helps Public Water Systems avoid crisis planning during emergency situations.

There are four parts to this Contingency Plan:

1. Emergency Response;
2. Rationing;
3. Remediation; and
4. Alternative Supplies and Source Development

A portion of the Contingency Plan is included in **Appendix G.**

The required Contingency Plan was previously submitted for the entire water system. It is a "Stand Alone" document and is not included in this report but was submitted and approved as a separate document.

11.0 PUBLIC NOTIFICATION

The Drinking Water Source Protection report calls for individual mailings to be sent to each PCS within the Spring delineated protection zones. These mailing should be sent to PCS's, individual residences, or property owners that fall within the recharge area.

11.1 Public Notification Plan

The public must be notified of the general conclusions drawn from the DWSP planning efforts. The following information from Section 11.2 should be included in the Consumer Confidence Reports. PCS notification should continue through the annual mailings as outlined in the Management Strategies section of the original report. This information may also be included in those mailings if the City chooses to do so. These mailings are specified to be completed at the end of each year.

11.2 Public Notification

Pleasant View City Corporation is required by the State of Utah to prepare and continually update a Drinking Water Source Protection (DWSP) study of all of the City's culinary water sources. The study identifies the geographic areas that each source draws its water from and inventories Potential Contamination Sources (PCS's) within those areas. It also includes plans to manage the existing PCS's as well as monitor and manage possible future PCS's. The City's Little Missouri Spring was updated this year (2015) and the City will continue to monitor and manage all their water sources so as to provide the highest quality drinking water possible.

The following information is to inform the public of the current status of the Little Missouri Spring. It includes a summary of the PCS's that may contribute to the springs as well as an analysis of the susceptibility to contamination. The full DWSP study is available from the City upon request.

11.2.a General Setting

Little Missouri Spring is located within a ravine on the west side of Pleasant View City. The property on which it is located is owned by Pleasant View City. The spring collection area is fenced.

11.2.b PCS Summary

The Potential Contamination Sources (PCSs) of the springs include the following activities:

- Septic Systems
- Farmland and/or Livestock Operations
- General Residential Properties
- Undeveloped Roadways
- Private Roads and Sewer Lines
- Active & Abandoned Wells

11.2.c Susceptibility

Although Pleasant View's water sources are susceptible to contamination, generally, the probability of contamination is low due to the small number of residences, and transportation of hazardous materials is small resulting from limited access to the area. As this area develops, proper management practices will be taken to ensure the protection of the spring. Through continuous monitoring of potential contamination sources and a history of clean water delivery, Pleasant View City's Water System will continue to provide

safe high quality drinking water.

11.2.d Land Management Strategies

Groundwater is a primary source of drinking water for Pleasant View City. As such, it is important that this vital resource be protected from contamination. Preventing contamination is the easiest and most cost effective way to keep this water supply safe. Following sound management controls can serve as an important component of a source protection program to control groundwater contamination. Therefore, it is Pleasant View City's objective to protect its water supply through preventative measures by developing management strategies to help potential contamination sources minimize their risk of contamination.

Pleasant View City uses a public education program that annually informs residents and potential contamination sources of their location within the recharge areas of the City's Drinking water sources and measures they can take to minimize or eliminate their impact on the sources. The City has also adopted a drinking water source protection ordinance within the City Boundaries that requires future businesses and other entities to take measures that prevent groundwater contamination from their property. Box Elder County, Weber County, and the Weber-Morgan Health department have all enacted Drinking Water Source Protection Ordinances. These ordinances will help in restricting future PCSs from moving into a protected zone outside of Pleasant View City's jurisdiction.

11.3 Obtaining DWSP Plans

A complete copy of the DWSP plan is available for review. Anyone interested in obtaining a copy of the plan should contact the Pleasant View City Culinary Water Department.

12.0 WAIVERS

12.1 General

Waivers are granted to PWSs when there appears to be no need for testing or limited testing for contaminants. There are three types of monitoring waivers: 1) Reliability and Consistency, 2) Use, and 3) Susceptibility.

The division of Drinking Water can grant the **reliability and consistency waiver** at their discretion, after the system has been tested, monitored, and reported, and the system has established a track record indicating the absence of the contaminant over a period of time.

Use waivers may be granted for either the volatile organic compounds (VOC) or the pesticide parameter group. To qualify for a use waiver, a system must verify that none of the chemicals or pesticides in the parameter groups have been used within the three-year time-of-travel zone withing the last five years. If a system does not qualify for a use waiver, it may still qualify for a susceptibility waiver. To qualify for a VOC and/or pesticide use waiver, a PWS must complete the following:

1. List the chemicals which are used, disposed, stored, transported, and manufactured at each potential contamination source within zones one, two, and three.

2. Submit a dated statement which is signed by the system's designated person that none of the VOCs and pesticides within these respective parameter groups have been used, disposed, stored, transported, or manufactured within the past five years within zones one, two, and three.

A susceptibility waiver allows the use, disposal, storage, transport, and manufacture of chemicals within Zone Three as long as they are controlled in such a manner as to prevent contamination of the system's wells or springs. The DWSP Plan must verify that land management strategies are implemented which will control the chemicals that are being used in Zone Three. This usually requires additional studies. In addition, the designated representative of the PWS would need to certify that to the best of their knowledge the known PCSs would not threaten public health. To qualify for a susceptibility waiver, a public water source must complete the following:

1. Submit the monitoring results of at least one applicable sample taken within the past five years from the VOC and/or pesticide parameter group(s). A non-detectable analysis for each chemical within the parameter group(s) is required.

2. Submit a dated statement from the designated person verifying that the Public Water System is confident that a susceptibility waiver will not threaten public health.

3. Verify that the source is developed in a protected aquifer, as defined in R309-600-6(1)(v), and have a public education program which addresses proper use and disposal practices for pesticides and VOCs as in the management sections of the DWSP plan.

12.2 Waivers

Little Missouri Spring has been granted a Use Waiver for pesticides, and a reliability and consistency waiver for VOCs. Through the enactment of this comprehensive Drinking Water Source Protection Plan document, Pleasant View City Corporation will be taking a pro-active role in ensuring that any *possible* potential contamination sources located within the DWSP zones of their drinking water sources will be either adequately controlled or controlled via appropriate management strategies.

****Use and susceptibility waivers must be updated each time your Drinking Water Source Protection Plans are updated or they will lapse.** (See form in Appendix J)**

APPENDICES

Appendix A - ***List of Contaminants and Regulations***

Appendix B - ***The Updated Spring Delineation Report***

Appendix C - ***City and County DWSP Ordinances***

Appendix D - ***Informational Mailer and Hazard Fact Sheets***

Appendix E - ***Property Ownership Lists***

Appendix F - ***Well Owners and Locations***

Appendix G - ***Portion of the Contingency Plan***

Appendix H - ***Record Keeping***

Appendix I - ***Water Quality Reports***

Appendix J - ***Waiver Checklist Forms***

Appendix K - ***Other***

List of Contaminants and Regulations

APPENDIX A

POTENTIAL CONTAMINATION SOURCES

1. Active and abandoned wells
2. Agricultural pesticide herbicide, and fertilizer storage, use, filling, and mixing areas
3. Airport maintenance and fueling sites
4. Animal feeding operations with more than ten animal units
5. Animal watering troughs located near unfenced wells and springs that attract livestock
6. Auto washes
7. Beauty salons
8. Boat builders and refinishers
9. Chemical reclamation facilities
10. Chemigation wells
11. Concrete, asphalt, tar, and coal companies
12. Dry cleaners
13. Farm dump sites
14. Farm maintenance garages
15. Feed lots
16. Food processors, meat packers, and slaughter houses
17. Fuel and oil distributors and storers
18. Furniture strippers, painters finishers, and appliance repairers
19. Grave yards, golf courses, parks, and nurseries
20. Heating oil storers
21. Industrial manufactures: Chemicals, pesticides, herbicides, paper and leather products, textiles, rubber, plastic, fiberglass, silicone glass, pharmaceutical, and electrical equipment etc.
22. Industrial waste disposal/ impoundment areas and municipal Wastewater treatment plants, landfills, dumps, and transfer stations
23. Junk and salvage yards
24. Laundromats
25. Machine shops, metal platers, heat treaters, smelters, annealers, and descalers
26. Manure piles
27. Medical, dental, and veterinarian offices
28. Mortuaries
29. Mining operations
30. Muffler shops
31. Pesticide and herbicide storers and retailers
32. Photo processors
33. Print shops
34. Radiological mining operations
35. Railroad yards
36. Research laboratories
37. Residential pesticide, herbicide, and fertilizer storage, use, filing, and mixing areas
38. Residential underground storage tanks
39. Roads, highways, and freeways
40. Salt and sand-salt piles
41. Sand and gravel mining operations
42. School vehicle maintenance barns
43. Sewer lines
44. Single-family septic tank/drain- field systems
45. Sites of reported spills
46. Small engine repair shops
47. Stormwater impoundment sites and snow dumps
48. Subdivision using subsurface wastewater disposal systems (large and individual septic tank/drain-field systems)
49. Submersible pumps used to pump wells
50. Taxi cab maintenance garage
51. Tire shops
52. Toxic chemical and oil pipelines
53. Vehicle chemical supply storers and retailers
54. Vehicle dealerships
55. Vehicle quick lubes
56. Vehicle rental shops
57. Vehicle repair, body shops, and rust proofers
58. Vehicle service stations and terminals
59. Wood preservers

POTENTIAL CONTAMINATES

1. PCB
2. Dioxin
3. Crude Oil
4. Gasoline
5. Diesel Oil
6. Other Distillate Fuel
7. Asphalt or other Residual
8. Animal or Vegetable Oil
9. Waste Oil
10. Other Oil
11. Petroleum Solvents
12. Naphtha
13. Mineral Spirits
14. Vermin Poisons
15. Insecticides
16. Nematicides
17. Herbicides
18. Fungicides
19. Antibiotics
20. Fertilizers
21. Metals
22. Acids
23. Organic Solvents
24. Caustics
25. Alcohols
26. Amines
27. Aldehydes
28. Radioactive Material
29. Brines
30. Sewage/Wastewater
31. Unknown/Other

TABLE 1
SUMMARY OF FEDERAL AND STATE REGULATIONS

REGULATORY AGENCY	REGULATION	DESCRIPTION
Division of Water Quality	R317-6, Utah Administrative Code (UAC)	***Ground Water Quality Protection Rule*** - regulates contaminated discharges to ground water
	R317-7, UAC	***Underground Injection Control Rule*** - regulated the subsurface emplacement of fluids through bored, drilled, driven, or dug wells
	R317-8, UAC	***Utah Pollutant Discharge Elimination System Rule*** - regulates the discharge of pollutants from point sources into waters of the State
	R317-5, UAC	***Large Underground Wastewater Disposal System Rule*** - regulates the discharge of wastewater to underground disposal systems
Division of Solid and Hazardous Waste	R315-1, UAC	***Hazardous Waste Rules, Resource Conservation and Recovery (RCRA)*** - regulates "cradle to grave" management of substances classified as hazardous wastes.
	R315-301 through R315-320, UAC	***Solid Waste Permitting and Management Rules*** (Landfills)
Division of Environmental Response and Remediation	R311-200 through R311-211	***Underground Storage Tank Rules*** - protects ground water resources by preventing and detecting leaks and spills from underground storage tanks.
	Section 19-6-301 through Section 19-6-325, Utah Code Annotated	***Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA commonly called Superfund)*** - regulates the release of, and remediation of hazardous substances.
Division of Environmental Response and Remediation	40 Code of Federal Regulations (CFR) Part 355	***SARA Title III*** - provides early comprehensive emergency planning for responding to potential releases of toxic chemicals.

TABLE 1 - Cont.

REGULATORY AGENCY	REGULATION	DESCRIPTION
Division of Water Rights	R655-4, UAC	***Water Well Rule*** - regulated the development of underground water.
	R655-4-12, UAC	***Abandoned water Wells*** - regulates the abandonment of wells.
Division of Oil, Gas and Mining	R643, UAC	***Oil, Gas and Mining; Abandoned Mine Reclamation*** - regulates
	R647, UAC	***Oil, Gas and Mining; Non-Coal*** - regulates reclamation of non-coal
	R645, UAC	***Oil, Gas and Mining; Coal*** - regulates coal exploration and coal mining
	R649, UAC	***Oil, Gas and Mining; Oil and Gas*** - state wide conservation of natural
	R649-5, UAC	*Class II Injection Wells* - regulates the emplacement of fluids into the
Department of Agriculture	R68-7, UAC	***Pesticide Control Rule*** - requires that pesticide application be in accordance with label directions.
U.S. Environmental Protection Agency	40 CFR	***Emergency Planning and Community Right-to-Know Act (EPCRA or SARA Title III)*** - regulation of chemicals and activities under RCRA and CERCLA
	40 CFR	***Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)*** - controls the manufacture, label sales and use of insecticides, fungicides and rodenticides.
	40 CFR	***Toxic Substance Control Act (TSCA)*** - regulates the use, storage and disposal of new chemical substances.
Public Utilities Commission	Part 49 CFR, 190-199	State adoption of Federal regulation for the design, construction, operation, inspection and reporting of pipelines.

Portion of the Delineation Report

APPENDIX B

PLEASANT VIEW CITY

DRINKING WATER SOURCE PROTECTION

DELINEATION REPORT UPDATE

LITTLE MISSOURI SPRING

(HAL Project No.: 249.01.200)

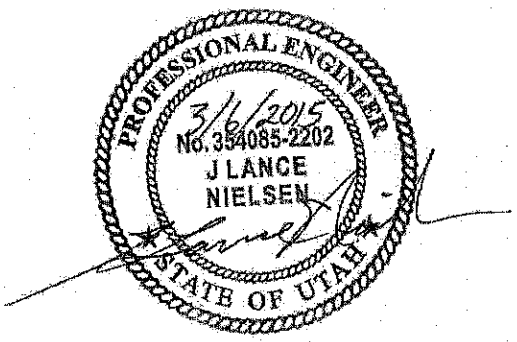
March 2015

HANSEN ALLEN & LUCE inc
ENGINEERS

PLEASANT VIEW CITY

DRINKING WATER SOURCE PROTECTION DELINEATION REPORT UPDATE

(HAL Project No.: 249.01.200)



Project Engineer

HANSEN ALLEN & LUCE inc
ENGINEERS

March 2015

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EXECUTIVE SUMMARY

This report is the updated Drinking Water Source Protection (DWSP) Delineation Report for Pleasant View City's Little Missouri Spring. The spring serves as a source of drinking water for the City's drinking water system. Source protection areas for the well have been delineated as defined in R309-600-9 (Utah Division of Administrative Rules, 2014).

Recent development near the spring resulted in the City investigating the construction of the spring to determine more precisely where the collection lines are located. Based on these investigations it was determined that the collection lines are located approximately 120 feet north of the collection box. The previous delineation assumed that the collection lines were located immediately adjacent to the collection box. This report updates the delineation of DWSP zones for Little Missouri Spring.

This report identifies and describes spring location, geologic and structural data, hydrogeology of the contributing aquifer(s), and the methodology and derivation of aquifer parameters used in the delineation of Drinking Water Source Protection zones. Aquifer parameters were developed using existing data and a constant rate pump test performed on the Mac Wade Well located upgradient from the Little Missouri Spring. Parameters developed for the Little Missouri Spring were used with Darcy's Law to assist in the delineation. Geologic mapping was used to determine the lateral and upgradient extent of the capture zone tributary to the spring. Source protection zones were overlain onto a map of the area, showing the relationship of these protection zones to surface features.

CHAPTER 1 - INTRODUCTION

Hansen, Allen & Luce, Inc. (HAL) was retained by Pleasant View City to update the Drinking Water Source Protection (DWSP) Delineation Report (PER) for their Little Missouri Spring. This report has been prepared in accordance with R309-600-9 (Utah Division of Administrative Rules, 2014).

This introduction addresses the water system information, source information, and designated person information.

SYSTEM INFORMATION

Pleasant View City
520 West Elberta Drive
Ogden, Utah 84414
(801) 782-8176
System Number: 29014

SOURCE INFORMATION

Little Missouri Spring is located approximately South 670 feet and West 470 feet from the north quarter corner of Section 19, Township 7 North, Range 1 West, Salt Lake Base and Meridian.

DESIGNATED PERSON

Mr. Fred Hellstrom, Water Superintendent
520 West Elberta Drive
Ogden, Utah 84414
(801) 782-8176

CHAPTER 2 – DELINEATION REPORT

Recent development near Little Missouri Spring resulted in the City investigating the construction of the spring to determine more precisely where the collection lines are located. Based on these investigations it was determined that the collection lines are located approximately 120 feet north of the collection box. The previous delineation assumed that the collection lines were located immediately adjacent to the collection box. This chapter updates the delineation of DWSP zones for Little Missouri Spring.

GEOLOGIC DATA

Information pertaining to the geology and hydrogeology in the vicinity of the spring has been obtained from the following sources:

> Clark, D.W., C.L. Appel, P.M. Lambert, R.L. Puryear. 1990. *Ground-Water Resources and Simulated Effects of Withdrawals in the East Shore Area of Great Salt Lake, Utah.* Technical Publication No. 93. State of Utah Department of Natural Resources, Salt Lake City Utah.
>
> Crittenden, M.D., M.L. Sorensen. 1985. *Geologic Map of the North Ogden Quadrangle and Part of the Ogden and Plain City Quadrangles, Box Elder and Weber Counties, Utah.* Map I-1606. U.S. Geological Survey, Salt Lake City, Utah.
>
> Montgomery, S. Bryce. 1995. *Pleasant View City Water Source Protection Study.* Bountiful, Utah.

General Geology

A composite figure illustrating the geology in the vicinity of Pleasant View City's drinking water sources has been included in the Appendix along with a copy of the associated geologic descriptions. Clark, et. al. (1990) described the general geologic setting of the Wasatch Mountain Range in the vicinity of Pleasant View and Ogden to be...

> *...composed of metamorphic and sedimentary rocks that range from Precambrian to Tertiary in age. The rocks in the Wasatch Range south of the Ogden River primarily are Precambrian gneiss, schist, and quartzite, whereas north of the river the Wasatch Range also contains Paleozoic limestones, dolomites, shales, and quartzites.*

Pleasant View City's drinking water sources are located just downgradient from the Wasatch Fault at the west base of Mt. Ben Lomond. As is common with most of the Wasatch Front, Mt. Ben Lomond receives significant annual precipitation. A portion of this precipitation infiltrates into the fractured bedrock formations of this mountain and eventually recharges the aquifers tributary to Pleasant View City's drinking water sources.

Bryce Montgomery (1995) described the hydrogeological setting of Pleasant View City's sources as follows:

Because of the combined effects of much faulting and highly variable sedimentation, both laterally and vertically, the groundwater storage and movement is complex within the salient area beneath Pleasant View City. Within the Alder Creek alluvial fan area, this creates a perched groundwater aquifer above the principal aquifer. However, within the lower, downgradient part of the Alder Creek alluvial fan area to the southwest and beneath the Mac Wade Well to the west, the perched aquifer and the principal aquifer merge. Thus, in cross section, there is a lense of impervious or very low permeability clay and silt or clayey silt and sand which extends from the Wasatch Fault near the Alder Creek Springs, southwestward and west towards the valley. Ground water discharging principally along and out of the Wasatch Fault, either to the land surface or within the subsurface directly into pervious gravel beds adjacent to the fault, become split in cross-section, causing the upper fork to become perched water which supplies both Alder Creek Springs and Little Missouri Spring, and the lower fork recharging the principal aquifer which supplies the Mac Wade Well and principal production of the Alder Creek Well.

A copy of a figure prepared by Bryce Montgomery (1995) showing potentiometric contours of both the perched and principal aquifers in the vicinity of Pleasant View City's sources is included in the Appendix.

Stratigraphy

The geologic formations present in the vicinity of the Pleasant View City sources consist of (Qf) Alluvial Fan Deposits, (Qt) Talus Deposits, (Qb) Lake Bonneville Deposits, (Qog) Older Gravel Deposits, (Ct) Tintic Quartzite, (Cm) Maxfield Limestone, (Co) Ophir Formation, and the (Xfc) Farmington Canyon Complex.

According to Crittenden and Sorensen (1985), the Alluvial Fan Deposits (Holocene) consist of, "...boulder to pebble-size gravel, sand, and silt in alluvial fans along Wasatch Front and along west edge of Ogden Valley; deposited after high stand of Lake Bonneville." There is a large area covered by these deposits northeast of the Little Missouri Spring.

Talus Deposits (Holocene) consist of locally derived rock fragments that are coarse and angular in nature (Crittenden and Sorensen, 1985). There are a few instances of these deposits on the mountain front northeast of the Alder Creek sources.

Crittenden and Sorensen (1985) indicates that the Lake Bonneville Deposits (Pleistocene) consist of, "...gravel, sand and silt deposited mainly during high stands of Lake Bonneville." The Little Missouri Spring is located within these deposits.

The Older Gravel Deposits (Pleistocene) consist of boulders, cobbles, and sand deposited at the mouths of Barrett, Alder Creek, and Ridge Canyons. These deposits are mostly older than the high stand of Lake Bonneville (Crittenden and Sorensen, 1985).

The Tintic Quartzite (Middle & Lower Cambrian) outcrops between the Farmington Canyon Complex and the Ophir Formation on the face of Mt. Ben Lomond northeast of Pleasant View City. According to Crittenden and Sorensen (1985), the Tintic Quartzite consists of...

...medium to coarse-grained, well-bedded, cliff-forming orthoquartzite with abundant cross bedding. Pebbles of pale-grey vein quartz [are] dispersed along bedding planes, increasing in abundance downward to form thin lenses of pebble conglomerate. Beds and lenses of cobble-size clasts [are] present near the base. Locally the basal beds are

friable, coarse-grained, grayish-red to white, arkosic sandstone that grades downward into gruss developed on the top of the underlying unit.

The Maxfield Limestone (Middle Cambrian) is divided into the Upper, Middle, and Lower Parts. The Upper Part consists of thin-bedded, finely crystalline, ledge-forming dolomite; near the top of unit includes laminated dolomite enclosed in limestone. The Middle Part consists of micaceous shale intercalated with mottled, cliff-forming limestone. The Lower Part consists of cliff-forming limestone and dolomite intercalated with limy shale. Locally oolitic and pisolitic, the Maxfield Limestone is about 300 meters thick (Crittenden and Sorensen, 1985). This formation overlies the Tintic Quartzite and Ophir Formation on the top of the Wasatch Range northeast of Pleasant View City.

The Ophir Formation (Middle Cambrian) consists of micaceous shale interbedded with thin silty limestone and rare beds of glauconitic sandstone or quartzite. It also includes thin beds of quartzite at the base (Crittenden and Sorensen, 1985). This formation is found between the Maxfield Limestone and the Tintic Quartzite.

According to Crittenden and Sorensen (1985), Farmington Canyon Complex (Lower Proterozoic) consists of...

...medium to coarse-grained quartz monzonite gneiss composed of quartz, plagioclase, and alkali feldspars in about equal amounts with minor biotite and ferrohastingsite hornblende. May include lenses of gneiss and schist derived from sedimentary rocks of Archean age. Unit is locally cut by numerous ptygmatically folded quartz veins generally 1 to 5 cm thick and by Plagioclase-hornblende amphibolite and Pegmatite dikes.

The Tintic Quartzite, Ophir Formation, and Maxfield Limestone are also located underneath the Alluvial Fan, Talus, Lake Bonneville Deposits, and Older Gravel deposits in the vicinity of the Little Missouri Spring. The aquifer tributary to the Little Missouri Spring likely is limited to the surficial deposits due to the location and the small yield (~6 gpm) of the spring.

Structure

The most significant structural features in this area are the Wasatch Fault Zone, Ogden Thrust, and the Willard Thrust. Crittenden and Sorensen (1985) indicate that the Wasatch Fault Zone encompasses the entire area between Pleasant View City and the base of Mt. Ben Lomond northeast of the City. Based on a cross-section prepared by Crittenden and Sorensen, the Ogden Thrust Zone is identified in the bedrock formations below the surface deposits about one-half mile east of Little Missouri Spring. The Willard Thrust is identified near Mt. Ben Lomond Peak and in the bedrock formations below the surface deposits roughly one-half of a mile west of Little Missouri Spring.

The interaction of these three fault systems in the vicinity of Mt. Ben Lomond and Pleasant View City has resulted in extensive faulting in these areas as shown in Exhibit A on geologic mapping by Crittenden and Sorensen (1985) and Bryce Montgomery (1995). It is very likely that the bedrock formations in this area are significantly fractured. Although faults are identified beneath the surficial deposits north of Little Missouri Spring, it is unlikely that these faults affect groundwater flow within these formations.

The bedrock formations above the Farmington Canyon Complex on Mt. Ben Lomond dip predominately to the east at angles of 30 to 50 degrees. However, the bedrock formations that

underlie the surface deposits near Pleasant View City are relatively flat and dip gently northeast towards the mountains.

Local Geology

Little Missouri Spring issues from the Lake Bonneville deposits about 7200 feet downgradient from the Wasatch Fault. The spring achieves its current flows (average: 6 gpm; peak: 14 gpm) through development of the Spring.

SPRING CONSTRUCTION DATA

The flow in the Little Missouri Spring is collected at the source by means of some unknown length of perforated collection pipe, which then flows south through approximately 120 feet of solid pipe into the spring box at an approximate elevation of 4,780 feet. The water is then diverted into a 6-inch diameter transmission pipeline and conveyed to a concrete storage reservoir. No construction drawings or construction data are available for the Little Missouri Spring. Little Missouri Spring has an average flow of 6 gpm and a peak flow of 14 gpm.

AQUIFER CHARACTERISTICS

The primary recharge area for the perched aquifer which is believed to be tributary to Little Missouri Spring is the upgradient bench area north and north-northeast from the spring. A relatively impermeable layer underlies this perched aquifer that stretches from the Wasatch Fault southwestward towards the valley. The Lake Bonneville deposits are assumed to be the primary groundwater system from which the spring discharges. According Crittenden and Sorensen (1985), this formation consists of gravels, sands, and silts.

The Mac Wade Well, located almost one mile north of Little Missouri Spring, is completed into unconsolidated sedimentary deposits (believed to be tributary to the spring) and in bedrock. Because of this and its proximity to the spring, aquifer properties determined from a constant rate pump test performed on this well were applied to the spring for delineation of source protection zones. A summary of the results of this test are included in Table 2-1.

Table 2-1
Aquifer Test Summary – Mac Wade Well

DESCRIPTION	MAC WADE WELL
Type of Analysis	Theis Unconfined & Cooper-Jacob Unconfined
Date of Test	November 2001
Pre-pumping Water Level	101 feet bgs
Pumping Rate	430 gpm
Time-Drawdown Data & Curves	See Appendix
Total Drawdown in Pumped Well	75.1 feet
Length of Drawdown Test	24 hours
Computed Transmissivity (T)	1,791 ft^2/day (Theis) 1,678 ft^2/day (Cooper-Jacob) 1,735 ft^2/day (average)
Aquifer Thickness (t) – perforated interval of well minus shale layers	265 feet
Computed Hydraulic Conductivity (K=T/t)	6.6 ft/day

The aquifer transmissivity for the Mac Wade Well was calculated using the computer modeling program "AQTESOLV" (Geraghty & Miller Modeling Group, 1992). AQTESOLV provides statistical parameter estimation methods with various graphical curve matching techniques. The test data was evaluated using the Theis and the Cooper-Jacob Solutions for unconfined aquifers. The transmissivities computed from the two methods were within 8% of each other. Therefore, it was assumed that average of these two methods was an accurate measure of the aquifer transmissivity. These methods plot drawdown during pumping vs. time and fit type curves or a straight-line to the resulting curve to determine the transmissivity. The hydraulic conductivity is computed by dividing the transmissivity by the thickness of the aquifer. This hydraulic conductivity is applied to the aquifer for Little Missouri Spring.

Hydraulic gradient and flow direction data for Little Missouri Spring were obtained from the potentiometric surface contours for the perched aquifer generated by Bryce Montgomery (1995). These contours were developed based on well logs and springs in the area. Contours developed for the perched aquifer indicate a gradient of 0.077 ft/ft at South 20° West in the immediate vicinity of Little Missouri Spring. About 2,000 feet north-northeast from the spring, there is a curve in the gradient from almost due south to South 20° West. The gradient and flow direction calculations can be found in the Appendix.

A precise determination of the porosity of the in-situ materials is not available. However, general assumptions of porosity values can be obtained based upon the general composition of the aquifer as reported by Crittenden and Sorensen (1985). They indicate that the Lake Bonneville deposits consist of gravel, sand, and silt. McWhorter and Sunada (1977) report average effective porosity values for fine gravels, sands, and silts of 28%, 32%, and 20%, respectively. Based on these values, the effective porosity for Little Missouri Spring was conservatively assumed to be 25%.

Table 2-2 summarizes the previously discussed aquifer properties for the Little Missouri Spring.

Table 2-2
Aquifer Characteristics Summary

Parameter	Anticipated Data
Average Hydraulic Conductivity (ft/day)	6.6
Effective Porosity	0.25
Hydraulic Gradient (ft/ft)	0.077
Direction of Groundwater Flow	South to South 20° W

HYDROGEOLOGIC METHODS, PROCEDURES AND CALCULATIONS

Delineation of DWSP Zones for the spring was performed using geologic mapping to define the extent of the capture zone in conjunction with Darcy's Law to determine travel-time distances for the 250-day and 3-year zones. Darcy's Law is reasonably applicable to the perched aquifer that supplies water to Little Missouri Spring because it is based on the assumption of groundwater flow through porous media.

The amount of water passing through the aquifer is a function of the permeability of the aquifer materials and the difference in pressure head. This relationship is known as Darcy's Law. The governing equation and definition of parameters are defined as follows:

$$v = k\,i$$

Where:

v = velocity (L/T)
k = permeability (L/T)
i = hydraulic gradient (L/L)

This equation is further modified because flow can only occur through that portion of the cross-sectional area occupied by voids. As a result, the average linear velocity of flow within the aquifer becomes:

$$v^* = v / n$$

Where:

v* = average linear velocity (L/T)
v = velocity (L/T)
n = effective porosity (dimensionless)

Based on the above equation, the average linear velocity (v*) is inversely proportional to the effective porosity (n). The distance that a particle of water will move over a given increment of time is simply the average linear velocity multiplied by time.

Based on these equations and the aquifer parameters shown in Table 2-2, the travel time distances for the 250-day and 3-year zones are calculated as follows:

250-day zone distance:

[(k x i) / n] x time = [(6.6 ft/day x 0.077) / 0.25] x 250 days = 508 feet

3-year zone distance:

[(k x i) / n] x time = [(6.6 ft/day x 0.077) / 0.25] x 1,095 days = 2,226 feet

The maximum discharge from Little Missouri Spring is 14 gpm (0.03 cfs). Therefore, the maximum discharge rate is equivalent to 22.6 ac-ft/yr. The normal annual precipitation for the bench area upgradient from Little Missouri Spring as reported by Jeppson, et. al. (1968) is approximately 25 in/yr. Assuming that 20% of the total precipitation contributes to recharge of the groundwater (Roark, 1991), 54 acres of capture area are required to hydrologically balance the maximum discharge rate (see Appendix). The delineated zone for the spring is approximately 284 acres, which is greater than the area required from a recharge standpoint. Based on these recharge calculations, the delineated protection zones appear to be conservative.

The capture zone extent is based primarily upon the potentiometric contours of the perched aquifer developed by Bryce Montgomery (1995). Due to the shallowness of the aquifer, surface topography plays an important role in the groundwater flow patterns tributary to Little Missouri Spring. This is evident in that the potentiometric contours are generally parallel with the surface elevation contours. Based on this information, the capture zone extends from the spring to the north-northeast terminating at the Weber/Box Elder County line which is also a topographic and hydrologic divide.

DELINEATION OF DRINKING WATER SOURCE PROTECTION ZONES

The DWSP Zones shown on Figure 2-1 reflect the maximum extent of groundwater tributary to the spring using geologic mapping to define the capture area for the spring and Darcy's Law to define the maximum calculated travel-time distance for the 250-day and 3-year zones.

Geologic Mapping

Little Missouri Spring is located within a ravine on the west side of Pleasant View City. The capture zone for this spring begins at a point roughly 100 feet downgradient from the spring to account for the 100 foot radius for zone 1. From this point, the boundary extends to the east and to the west up both slopes of the ravine until it reaches the top on each side. It is unlikely that groundwater south of this boundary will reach the spring due to it being downgradient from both a topologic and a hydrologic standpoint. From the these points at the top of each side of the ravine, the capture zone boundary follows the potentiometric surface upgradient to the north and north-northeast perpendicular to the potentiometric surface contours developed by Bryce Montgomery (1995) for the perched aquifer.

The eastern boundary as defined by the potentiometric surface travels north-northeast for approximately 6,500 feet and then bends to the north until it reaches the Weber/Box Elder County line just west of the Wasatch Fault. The western boundary as defined by the potentiometric surface travels to the north until it reaches the topologic divide that corresponds to the Weber/Box Elder County line. Based on Bryce Montgomery (1995), this divide also serves as a hydrologic divide. Therefore, the boundary then follows the County line to the east-northeast until it closes with the eastern boundary at the point just west of the Wasatch Fault mentioned above. The potentiometric surface defined by Bryce Montgomery (1995) indicates that groundwater within the perched aquifer that is located outside of these boundaries would not be tributary to Little Missouri Spring.

DWSP Zone 1

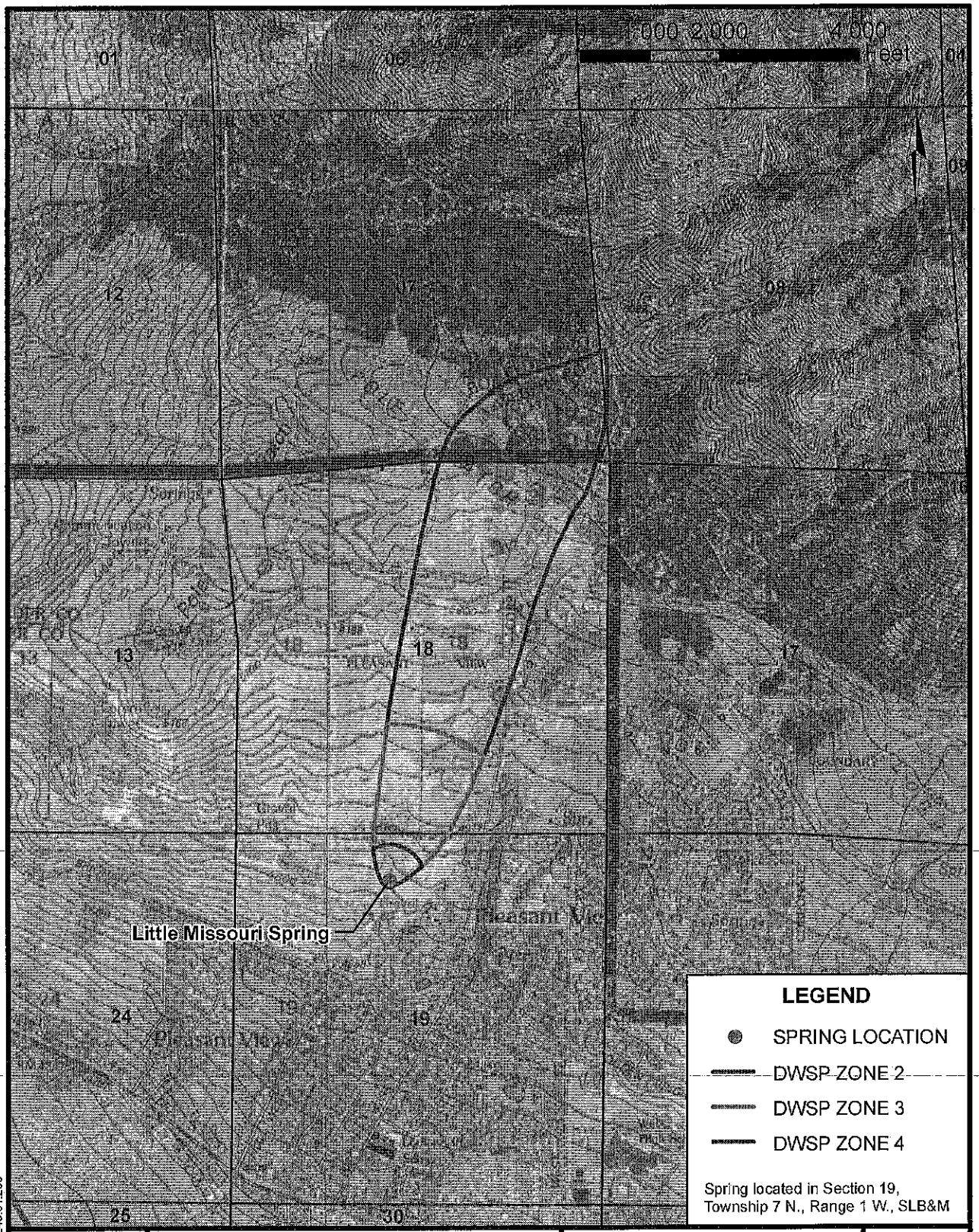
Due to map scale, the 100-foot radius around the well is not shown on Figure 2-1.

DWSP Zones 2, 3, and 4

DWSP zones 2, 3, and 4 shown on Figure 2-1 and summarized in Table 2-3, include the extent of the capture area within the 250-day, 3-year, and 15-year groundwater travel time periods.

Table 2-3
Limits of DWSP Zones 2, 3, and 4

DWSP Zone	Width/Length	Value
2	Width (E-W)	725 feet
	Length (N-S)	608 feet
3	Width (E-W)	1,470 feet
	Length (N-S)	2,330 feet
4	Width (E-W)	2,150 feet
	Length (N-S)	8,260 feet



HAL Project No.: 249.01.200

HANSEN ALLEN & LUCE inc ENGINEERS

PLEASANT VIEW CITY
DWSP DELINEATION REPORT UPDATE
LITTLE MISSOURI SPRING

DRINKING WATER SOURCE PROTECTION ZONES

FIGURE
2-1

REFERENCES

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Crittenden, Max D., Jr., Martin L. Sorensen. 1985. *Geologic Map of the North Ogden Quadrangle and Part of the Ogden and Plain City Quadrangles, Box Elder and Weber Counties, Utah.* Map I-1606. U.S. Geological Survey, Washington, D.C.

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McWhorter, D.B., and D.K. Sunada. 1977. *Ground-Water Hydrology and Hydraulics.* Water Resources Publications, Fort Collins, Colorado.

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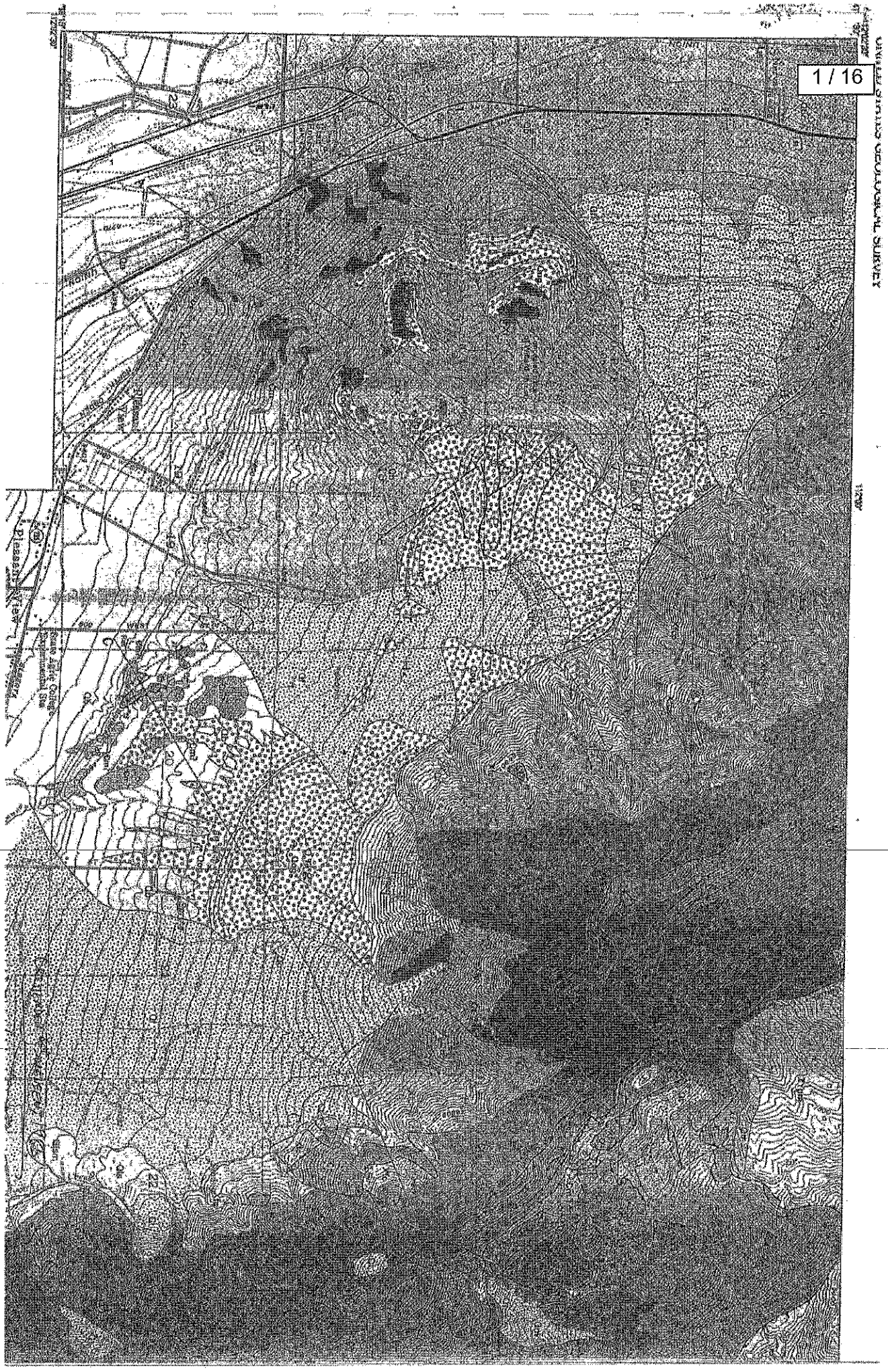
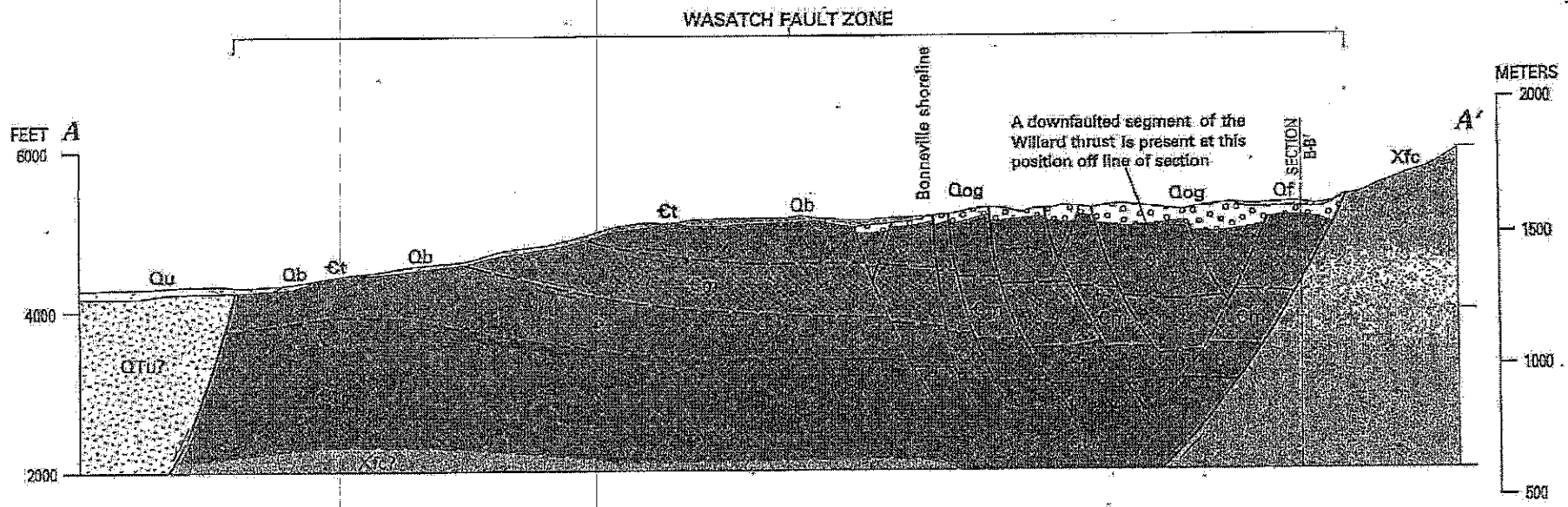
Utah Division of Administrative Rules. 2014. *Utah Administrative Code, R309.* The Department of Administrative Services. Salt Lake City, Utah.

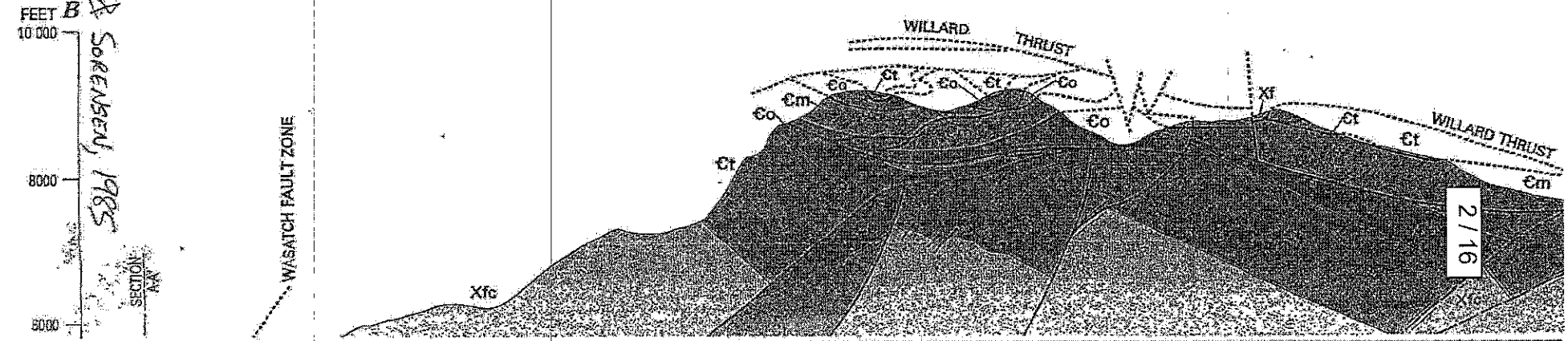
APPENDIX A

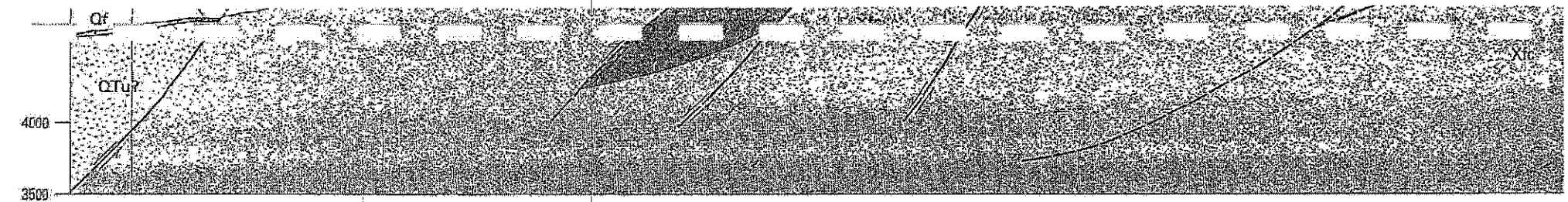
Geologic Information
Pump Test Data & Analysis
Aquifer Calculations

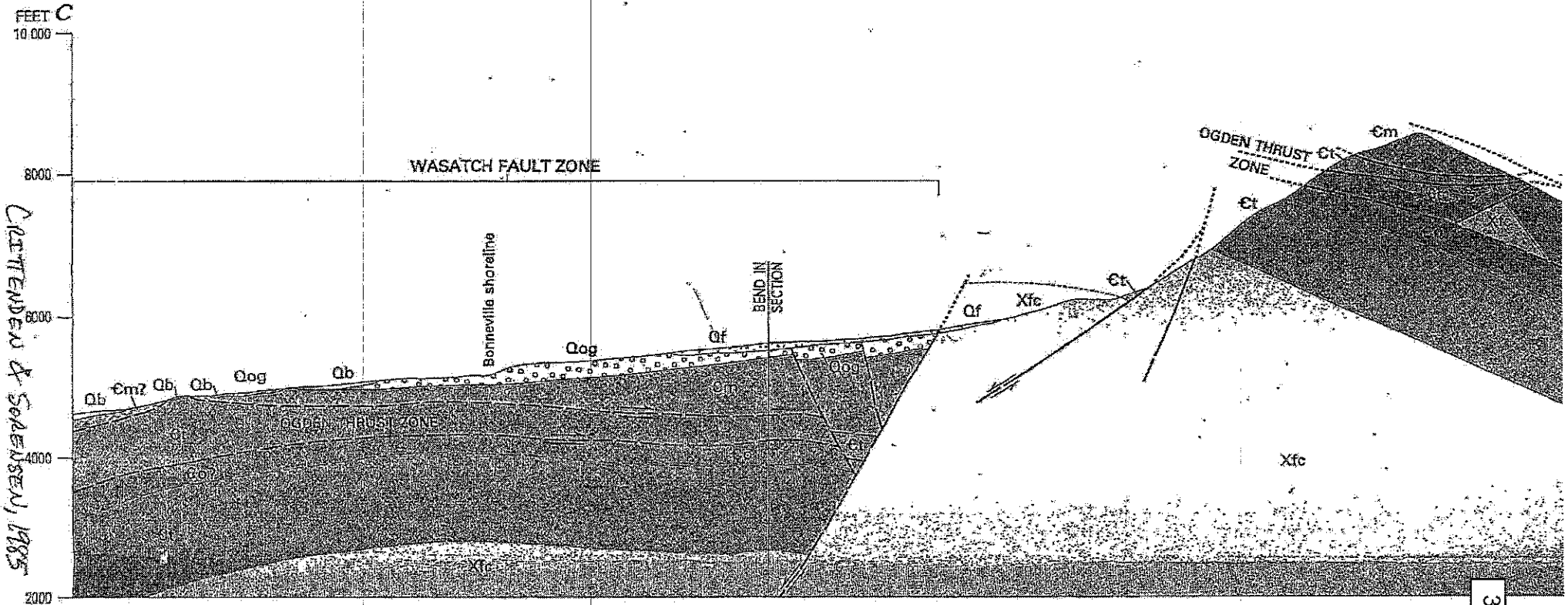

1 / 16

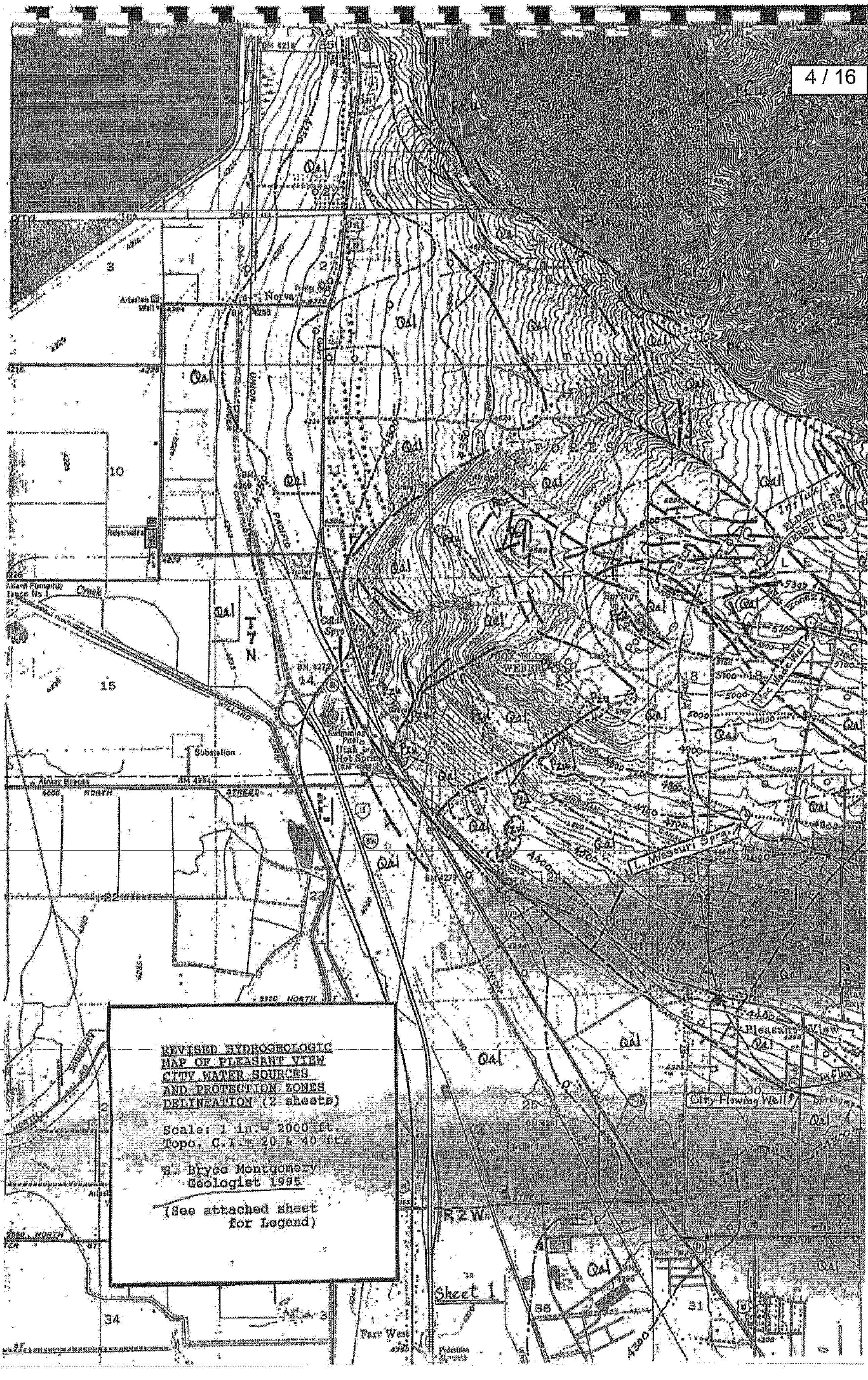


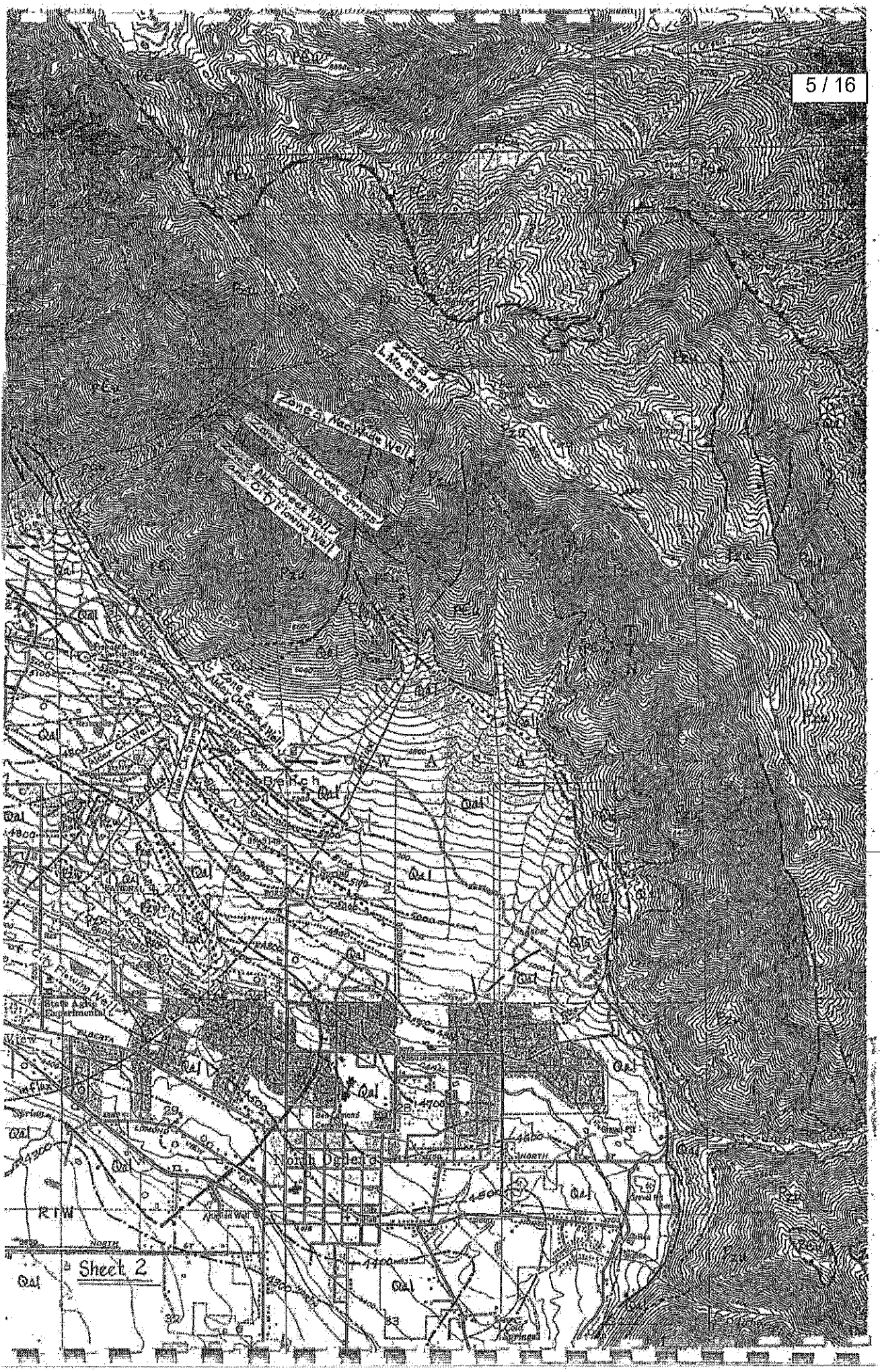
Crittenden & Sorensen, 1985




Qf
QTu?
Xfc
4000
3500


FEET
C
10,000
8000
6000
4000
2000
WASATCH FAULT ZONE
Bonneville shoreline
BEND IN SECTION
OGDEN THRUST ZONE
Qb
Cm?
Qog
Qf
Cm
Ct
Xfc
Qoc
CRITTENDEN & SORENSEN, 1985


REVISED HYDROGEOLOGIC
MAP OF PLEASANT VIEW
CITY WATER SOURCES
AND PROTECTION ZONES
DELINEATION (2 sheets)
Scale: 1 in. = 2000 ft.
Topo. C.I. = 20 & 40 ft.
S. Bryce Montgomery
Geologist 1995
(See attached sheet for Legend)
Sheet 1
L. Missouri Sprs.
City Flowing Well
Pleasant View
Reservoirs
Substation
Creek
T 7 N
R 2 W
Farr West


Zone 2 Mac Main Well
Zone 2 Allen Creek Spring
Zone 2 Allen Creek Well 2
Zone 2 Allen Creek Well 1
Zone 2 Allen Creek Well
Allen Cr. Well
Allen Cr. Spring
Berlich
North Ogden
Sheet 2
Qal
Tcu
R1W

LEGEND for Revised Hydrogeologic Map of Pleasant View City Water Sources and Protection Zones Delineation

S. Bryce Montgomery, Geologist 1995

Geology modified from Crittenden, M. D., Jr. & Sorensen, M. L., 1985; Feth, J. H., et al, 1966; Eardley, A. J., 1944; Miller, R. D., 1980; Nelson, A. R. & Personius, S. F., 1993; and Personius, S. F., 1990

Qal= Quaternary age alluvium, undifferentiated

Qls= Quaternary age landslide deposit

Pzu= Paleozoic age, undifferentiated bedrock formations of shale, sandstone, quartzite, limestone and dolomite

p-Cu= Precambrian age, undifferentiated bedrock formations of metamorphic rocks consisting of gneiss, schist, pegmatite, phyllite, quartzite, argillite, metaquartzite; and siltstone-graywacke, conglomerate, mudstone, slate, and limestone

Approximate formation contact

Fault; bar-ball on downthrown side

Thrust fault; teeth on upper plate

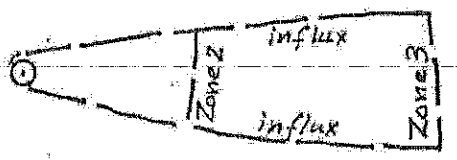
o Well used for control

5000 Potentiometric groundwater surface contour of perched aquifer

4900 Potentiometric groundwater surface contour of principal aquifer

Service station with buried gasoline tanks

Septic tank and drainfield



Pleasant View City well or spring with influx and delineation zones designated

HANSEN ALLEN & LUCE inc ENGINEERS

CLIENT Pleasant View
PROJECT DWSP
FEATURE Aquifer Characteristics Calculations
PROJECT NO 1249.01.100

SHEET ___ OF ___
COMPUTED ___
CHECKED ___
DATE 11/28/2001

TRANSMISSIVITY & HYDRAULIC CONDUCTIVITY

MAC WADE WELL:

This well is completed into an unconfined aquifer.

Based on 24-hour Constant-rate Pump Test performed in November 2001, and using Aqtesolv, the following Transmissivities were obtained:

Theis Unconfined : $T = 1,791$ ft²/day
Cooper-Jacob Unconfined: $T = 1,678$ ft²/day

Average = 1,735 ft²/day

Hydraulic Conductivity
$K = \frac{T}{b} = \frac{1735}{265} =$ 6.55 ft/day

ALDER CREEK WELL:

Unconfined Aquifer

Based on 24-hour Constant-rate Pump Test performed in November 2001, and using Aqtesolv, the following Transmissivities were obtained:

Theis Unconfined : $T = 7,850$ ft²/day
Cooper-Jacob Unconfined : $T = 6,000$ ft²/day

Average = 6,925 ft²/day

Hydraulic Conductivity
$K = \frac{T}{b} = \frac{6925}{51} =$ 136 ft/day → Use also for Alder Creek Springs

PROPOSED NEW WELL:

Use average Hydraulic Conductivity of Mac Wade & Alder Creek Wells due to central location of this well between the two.

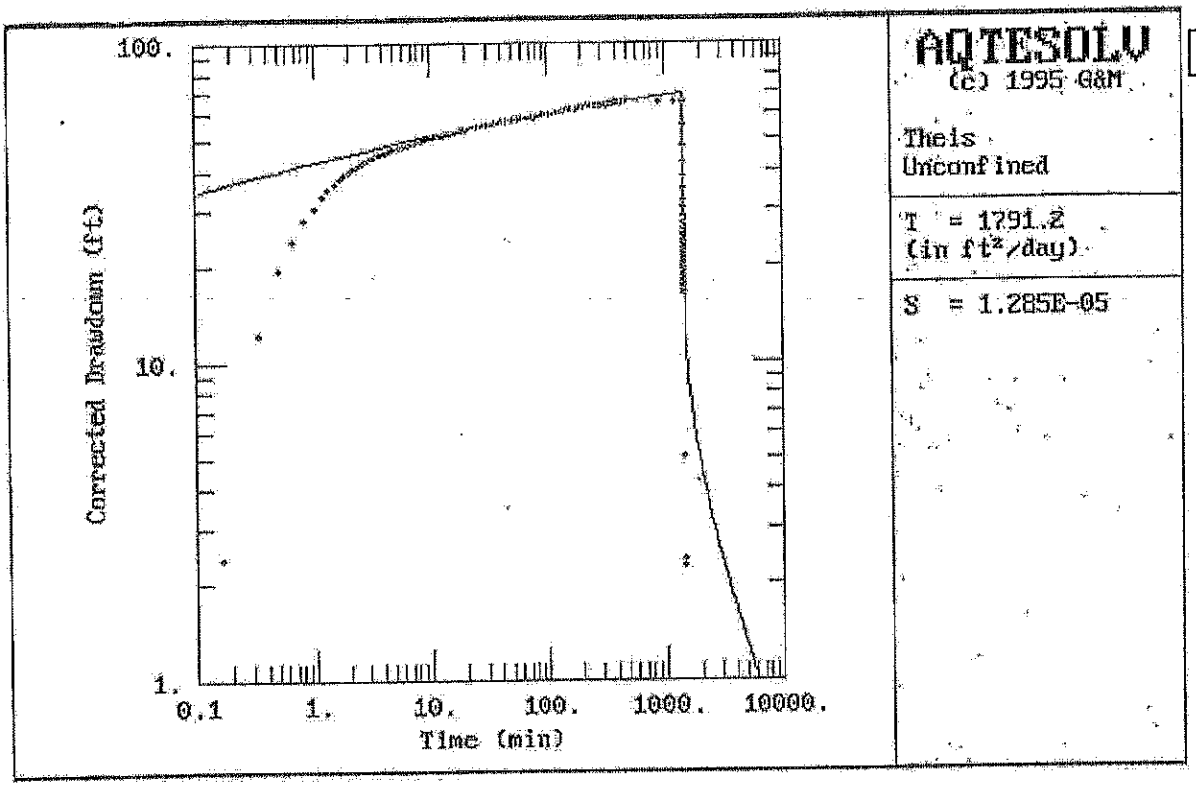
$K = \frac{136 + 6.6}{2} = 71.3$ ft/day USE 70 ft/day

$T = Kb = (70)(158) =$ 11,060 ft²/day

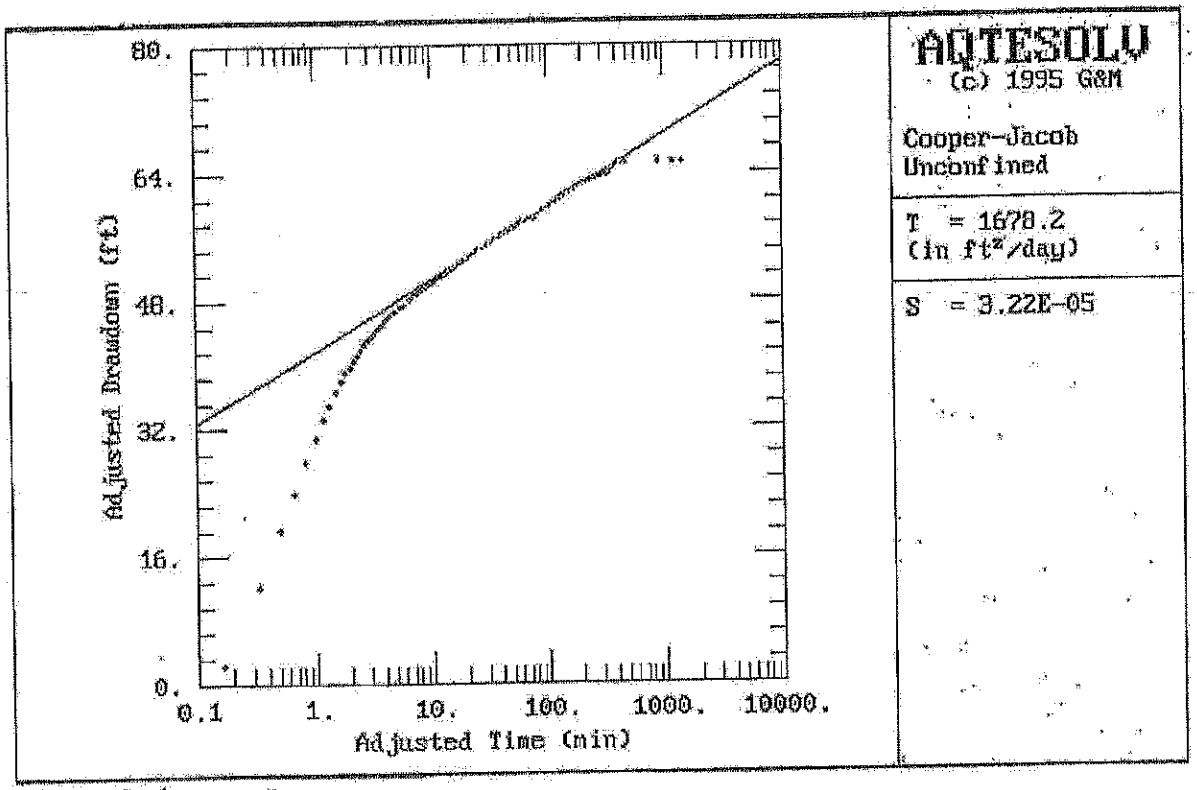
MAXIMUM PROTECTED PUMPING RATES

MAC WADE WELL: 430 gpm
ALDER CREEK WELL: 400 gpm
PROPOSED NEW WELL: 1350 gpm.

3 cfs



Mac Wade Well



Mac Wade Well

Mac Wade Well 10/16

AQUIFIER DRAWDOWN TEST

Community: Pleasant View City

Flow: 430 G.P.M. MAC'S Reservoir

Starting time: 7:53 A

Equipment Using: Well Level Control, and MAG meter

AirLine Length: 210' Well Level Probe

Static Level: 109.3 Feet

	Reading	Drawdown										
0:00:10	106.9	2.4	0:04:50	58.2	51.1	0:25:00	48.7	60.6	5:45:00	36.1	73.2	
0:00:20	96.9	12.4	0:05:00	58	51.3	0:30:00	47.7	61.6	6:00:00	35.5	73.8	
0:00:30	89.2	20.1	0:05:30	57.3	52	0:35:00	46.8	62.5	6:15:00	35.3	74	
0:00:40	84.1	25.1	0:06:00	56.9	52.4	0:40:00	46.1	63.2	6:30:00	35	74.3	
0:00:50	80	29.3	0:06:30	56.2	53.1	0:45:00	45.5	63.8	6:45:00	34.7	74.6	
0:01:00	76.8	32.5	0:07:00	55.8	53.5	0:50:00	45	64.3	7:00:00	34.4	74.9	
0:01:10	74	35.3	0:07:30	55.4	53.9	0:55:00	44.5	64.8	7:30:00	34.3	75	
0:01:20	72	37.3	0:08:00	55	54.3	1:00:00	44	65.3	G.P.M.	405		
0:01:30	70	39.3	0:08:30	54.6	54.7	G.P.M.	416		8:00:00	34.2	75.1	
0:01:40	68.6	40.7	0:09:00	54.4	54.9	1:15:00	43.5	65.8	8:30:00	34.2		
0:01:50	67.3	42	0:09:30	54	55.3	1:30:00	42.1	67.2	9:00:00	34.2		
0:02:00	66.3	43	0:10:00	53.7	55.6	1:45:00	41.5	67.8	9:30:00	34.2		
0:02:10	65.4	43.9	0:10:30	53.4	55.9	2:00:00	40.6	68.7	10:00:00	34.2		
0:02:20	64.6	44.7	0:11:00	53.2	56.1	2:15:00	39.9	69.4	11:00:00	34.2		
0:02:30	63.8	45.5	0:11:30	52.9	56.4	2:30:00	39.4	69.9	12:00:00	34.2		
0:02:40	63.1	46.2	0:12:00	52.7	56.6	2:45:00	38.9	70.4	13:00:00	34.2		
0:02:50	62.5	46.8	0:12:30	52.6	56.7	G.P.M.	412		14:00:00	34.2		
0:03:00	62	47.3	0:13:00	52.3	57	3:00:00	38.5	70.8	15:00:00	34.2		
0:03:10	61.5	47.8	0:13:30	52.1	57.2	3:15:00	38	71.3	16:00:00	34.2		
0:03:20	61.1	48.2	0:14:00	51.9	57.4	3:30:00	37.7	71.6	17:00:00	34.2		
0:03:30	60.7	48.6	0:14:30	51.7	57.6	3:45:00	37.4	71.9	18:00:00	34.2		
0:03:40	60.3	49	0:15:00	51.5	57.8	4:00:00	37.1	72.2	19:00:00	34.2		
0:03:50	59.9	49.4	G.P.M.	426		4:15:00	37	72.3	20:00:00	34.2		
0:04:00	59.4	49.9	0:16:00	51.1	58.2	4:30:00	36.9	72.4	21:00:00	34.2		
0:04:10	59.2	50.1	0:17:00	50.8	58.5	4:45:00	36.8	72.5	22:00:00	34.2		
0:04:20	59	50.3	0:18:00	50.5	58.8	5:00:00	36.7	72.6	23:00:00	34.2		
0:04:30	58.7	50.6	0:19:00	50.3	59	5:15:00	36.5	72.8	0:00:00	34.2		
0:04:40	58.4	50.9	0:20:00	50.	59.3	5:30:00	36.5	72.8				

comments:

7

Maic Wade Well
11 / 16

AQUIFIER RECOVERY TEST

Recovery

Community: Pleasant View City

Flow: G.P.M. MAC'S Reservoir

Starting time: 7:33 4

Equipment Using: Well Level Control Probe & Map meter

AirLine Length: 210' Well Level Probe

Static Level

0:00:10	47.8	61.5	0:04:50	92.2	17.1	0:25:00			5:45:00		
0:00:20	57.1	52.2	0:05:00	92.5	16.8	0:30:00			6:00:00		
0:00:30	63.2	46.1	0:05:30	104.2	5.1	0:35:00			6:15:00		
0:00:40	68.1	41.2	0:06:00	106.9	2.4	0:40:00			6:30:00		
0:00:50	72.0	37.3	0:06:30	106.9	2.4	0:45:00			6:45:00		
0:01:00	75	34.3	0:07:00	106.9	2.4	0:50:00			7:00:00		
0:01:10	77	32.3	0:07:30	106.9	2.4	0:55:00			7:30:00		
0:01:20	79	30.3	0:08:00	106.9	2.4	1:00:00			G.P.M.	0	
0:01:30	80.6	28.7	0:08:30	107	2.3	G.P.M.	0		8:00:00		
0:01:40	81.9	27.4	0:09:00	107		1:15:00			8:30:00		
0:01:50	83.1	26.2	0:09:30	107		1:30:00			9:00:00		
0:02:00	84.1	25.2	0:10:00	107		1:45:00			9:30:00		
0:02:10	84.9	24.4	0:10:30	107		2:00:00			10:00:00		
0:02:20	85.7	23.6	0:11:00	107		2:15:00			11:00:00		
0:02:30	86.4	22.9	0:11:30	107		2:30:00			12:00:00		
0:02:40	87	22.3	0:12:00	107		2:45:00			13:00:00		
0:02:50	87.7	21.6	0:12:30	107		G.P.M.			14:00:00		
0:03:00	88.2	21.1	0:13:00	107		3:00:00			15:00:00		
0:03:10	88.7	20.6	0:13:30	107		3:15:00			16:00:00		
0:03:20	89.2	20.1	0:14:00	107		3:30:00			17:00:00		
0:03:30	89.6	19.7	0:14:30	107		3:45:00			18:00:00		
0:03:40	90	19.3	0:15:00			4:00:00			19:00:00		
0:03:50	90.3	19	G.P.M.	0		4:15:00			20:00:00		
0:04:00	90.7	18.6	0:16:00			4:30:00			21:00:00		
0:04:10	91	18.3	0:17:00			4:45:00			22:00:00		
0:04:20	91.4	17.9	0:18:00			5:00:00			23:00:00		
0:04:30	91.7	17.6	0:19:00			5:15:00			0:00:00	107	
0:04:40	92	17.3	0:20:00			5:30:00					

comments:

LITTLE MISSOURI SPRING

Located in Secondary Recharge Area according to Clark, et al (1990) - "Groundwater Resources and Simulated Effects of Withdrawals in the East Shore Area of Great Salt Lake, Utah" Tech Pub No. 95

Hydraulic Conductivity

- According to Crittendon and Secenser (1985) - "Geologic Map of the North Ogden Quad..." the spring is located in Lake Bonneville Deposits (Qb) which are described as:

"Gravel, sand, and silt deposited mainly during high stands of Lake Bonneville."

because the Little Missouri Spring is located 4000 feet downgradient of the highest point of this formation, it is assumed that there is a higher percentage of sands & silts than of gravels.

ASSUME: GRAVEL: 10%
SAND: 40%
SILT: 50%

From McWhorter & Sunada (1977)

Material	Ave K (ft/day)
Gravel	1140
Sand (med)	40
Silt	0.08

Because this small percentage of gravel it likely doesn't contribute to the permeability. Therefore assume the remaining percentage of sand and silt or:

$$\text{Sand} = \frac{40}{90} = 45\%$$
$$\text{Silt} = \frac{50}{90} = 55\%$$

$$\therefore K = (40)(0.45) + (0.08)(0.55) = 18 \text{ ft/day}$$

- The pump test for the MacWade Well which is completed into 185 feet of valley fill material & 80 feet of fractured bedrock material had a K = 6.6 ft/day.

- ~~KLS Safety Factor~~ The pump test data is the most accurate data because it directly reflects the valley fill material in the area of the Little Missouri Spring.

Porosity

McWhorter & Sunada (1977) estimate the following effective porosities

Sand (Med) = 0.32

Silt = 0.20

$\therefore n = (0.32)(0.45) + (0.2)(0.55) = 0.25$

or $n = 25\%$

Gradient:

From potentiometric contours of perched aquifer by Bryce Montgomery (1995),

$i = \frac{100}{1300} = 0.077$ ft/ft

@ S 20° W

USING DARCY'S LAW

v = velocity $= \frac{ki}{n}$

assuming $K = 180$ ft/day $\quad v = \frac{(180 \text{ ft/day})(0.077 \text{ ft/ft})}{0.25} = 5.544$ ft/day

@ 250 days, Distance = 1,386 ft

13 years, D = 6,070 ft

15 years, D = 30,353 ft

assuming $K = 66$ ft/day $\quad v = 2.0$ ft/day

250 days, D = 500 ft

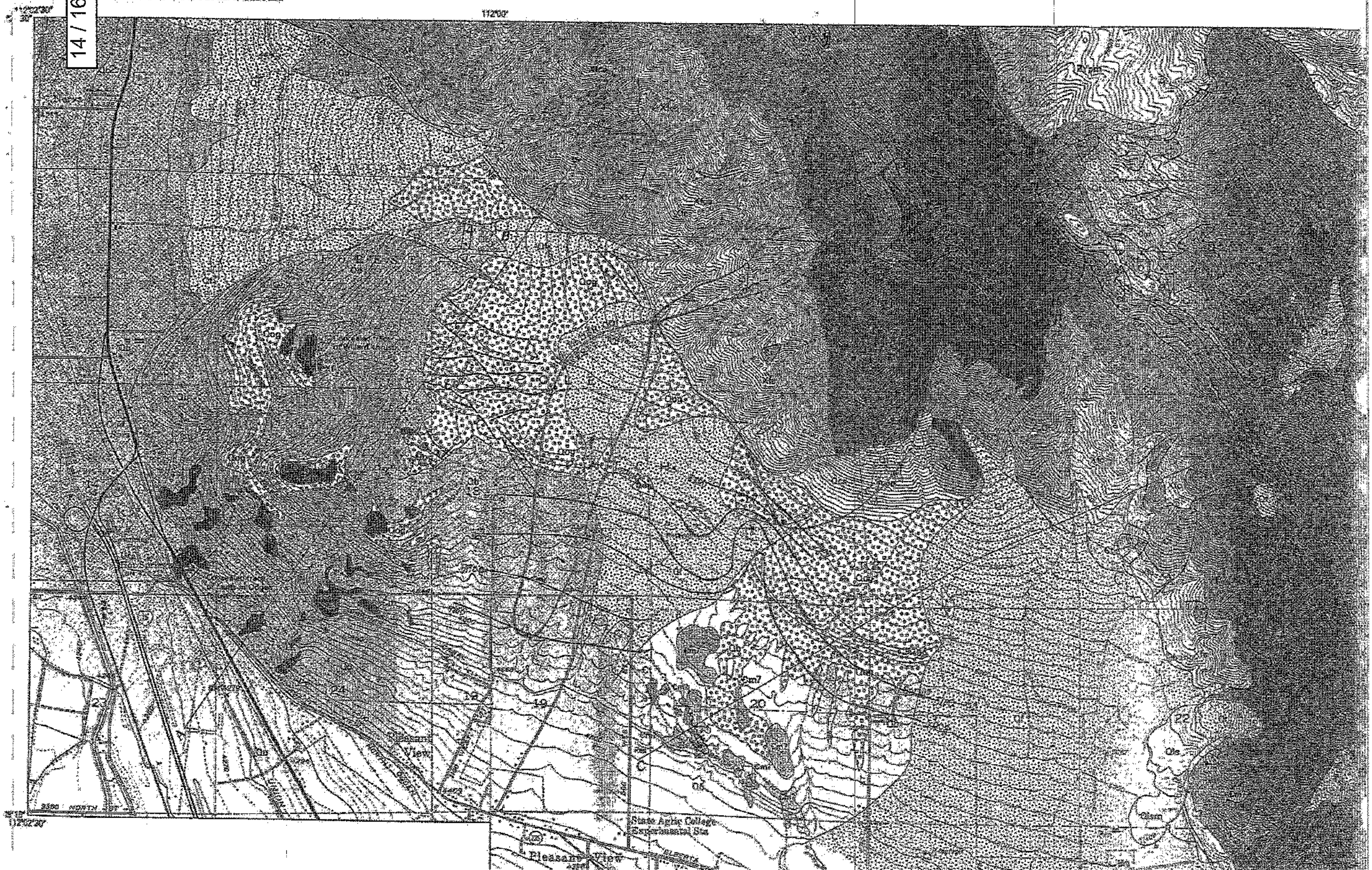
3 years, D = 2190 ft

15 years, D = 10950 ft

USE These Values

It

UNITED STATES GEOLOGICAL SURVEY



Mac Wade Well

Form 113-SM-12-60

Examined ____ Recorded: B. C. ____ T. B. ____ Inspection Sheet ____ Ind ____

REPORT OF WELL DRILLER
STATE OF UTAH

Application No. 31855 (35-1172) Claim No. ____ Coordinate No. ____ 15 / 16

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:
Name Pleasant View Culinary Water
Address Pleasant View, Utah

(2) LOCATION OF WELL:
County Weber Ground Water Basin (leave blank)
1204 feet, South, 1217 feet, West from NE Corner of Section 18 T 7 N R 1 W SLBM (strike out words not needed)

(3) NATURE OF WORK (check): New Well ☒ Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐
If abandonment, describe material and procedure: ____

(4) NATURE OF USE (check): Domestic ☐ Industrial ☐ Municipal ☒ Stockwater ☐ Irrigation ☐ Mining ☐ Other ☐ Test Well ☐

(5) TYPE OF CONSTRUCTION (check): Rotary ☐ Dug ☐ Jetted ☐ Cable ☒ Driven ☐ Bored ☐

(6) CASING SCHEDULE: Threaded ☐ Welded ☒
12 " Diam. from 0 feet to 427 feet Gage 330
8 " Diam. from 415 feet to 530 feet Gage 312
" Diam. from ____ feet to ____ feet Gage ____
New ☒ Reject ☐ Used ☐

(7) PERFORATIONS: Perforated? Yes ☒ No ☐
Type of perforator used Mills Blade Type
Size of perforations 3/8 inches by 1 1/2 inches
perforations from 200 feet to 410 feet
perforations from 440 feet to 520 feet
perforations from ____ feet to ____ feet
perforations from ____ feet to ____ feet
perforations from ____ feet to ____ feet

(8) SCREENS: Well screen installed? Yes ☐ No ☒
Manufacturer's Name ____
Type ____ Model No. ____
Diam. ____ Slot size ____ Set from ____ ft. to ____
Diam. ____ Slot size ____ Set from ____ ft. to ____

(9) CONSTRUCTION:
Was well gravel packed? Yes ☐ No ☒ Size of gravel: ____
Gravel placed from ____ feet to ____ feet
Was a surface seal provided? Yes ☒ No ☐
To what depth? 60 feet
Material used in seal: Cement Grout
Did any strata contain unusable water? Yes ☐ No ☒
Type of water: ____ Depth of strata ____
Method of sealing strata off: ____
Was surface sealing used? Yes ☐ No ☒
Was it cemented in place? Yes ☐ No ☐

(10) WATER LEVELS:
Static level 60 feet below land surface Date 3-18-68
Artesian pressure ____ feet above land surface Date ____

(11) FLOWING WELL:
Controlled by (check) Valve ☐ Cap ☐ Plug ☐ No Control ☐
Does well leak around casing? Yes ☐ No ☐

(12) WELL TESTS: Drawdown is the distance in feet the water level is lowered below static level.
Was a pump test made? Yes ☒ No ☐ If so, by whom? J. S. Lee & Sons
Yield: 450 gal./min. with 90 feet drawdown after 101 hours
" ____ " ____ " ____ " ____
" ____ " ____ " ____ " ____
Bailer test ____ gal./min. with ____ feet drawdown after ____ hours
Artesian flow ____ g.p.m. Date ____
Temperature of water 53° Was a chemical analysis made? No ☒ Yes ☐

(13) WELL LOG: Diameter of well 12 inches
Depth drilled 530 feet. Depth of completed well 530 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material(s) or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc. of material encountered in each depth interval. Use additional sheet if needed.

DEPTH From	DEPTH To	Clay	Silt	Sand	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	Other	REMARKS
0	3											Top Soil
3	71	X			X							
71	79	X										Sandy
79	81	X			X							
81	95	X										Sandy
95	97	X					X					
97	130	X										Sandy
130	168	X			X							
168	171	X										
171	268	X			X							
268	272	X					X					
272	365	X			X							
365	439									X		Shale
439	530									X		Quartsite

Work started Jan. 3, 1968 Completed Mar. 18, 1968

(14) PUMP:
Manufacturer's Name ____
Type ____ H. P. ____
Depth to pump or bowls ____ feet

Well Driller's Statement:
This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.
Name J. S. Lee & Sons (Person, firm, or corporation) (Type or print)
Address 1091 South State, Salt Lake City
(Signed) Robert E. Lee (Well Driller)
License No. 11 Date April 17, 1968

RECEIVED APR 19 1968

USE OTHER SIDE FOR ADDITIONAL REMARKS

Groundwater Recharge System Calculations

Little Missouri Spring Maximum Flowrate = 14 gpm = 0.03 cfs

Mean Annual Precipitation (MAP) = 25 inches/year = 2.08 feet/year

Infiltration Potential - assumed to be **20%** of MAP due to the higher elevation of the proposed potential recharge area.

Infiltration = 2.08 ft/yr * 0.20 = 0.42 ft/yr

0.03 cfs = 22.6 ac.ft/yr

Area Recharge based on Maximum Flowrate:

$$Area\ Recharge = \frac{22.6\ ac.ft/yr}{0.42\ ft/yr} = 54\ acres$$

54 acres of capture area required based on Maximum Flowrate.
Delineated Area is approximately 284 acres.